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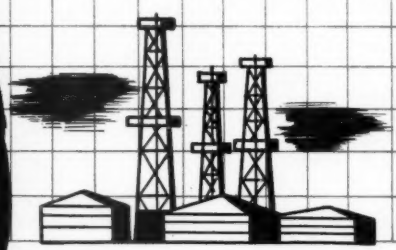

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211 S. CHEYENNE AVE., TULSA 1, OKLAHOMA

Subscription rate to the petroleum industry, United States and foreign, 1 year, $3.00. Single copies, 20 cents. Back copies, when over a year old, 50 cents. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879.

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Vol. 44, No. 33 December 22, 1945

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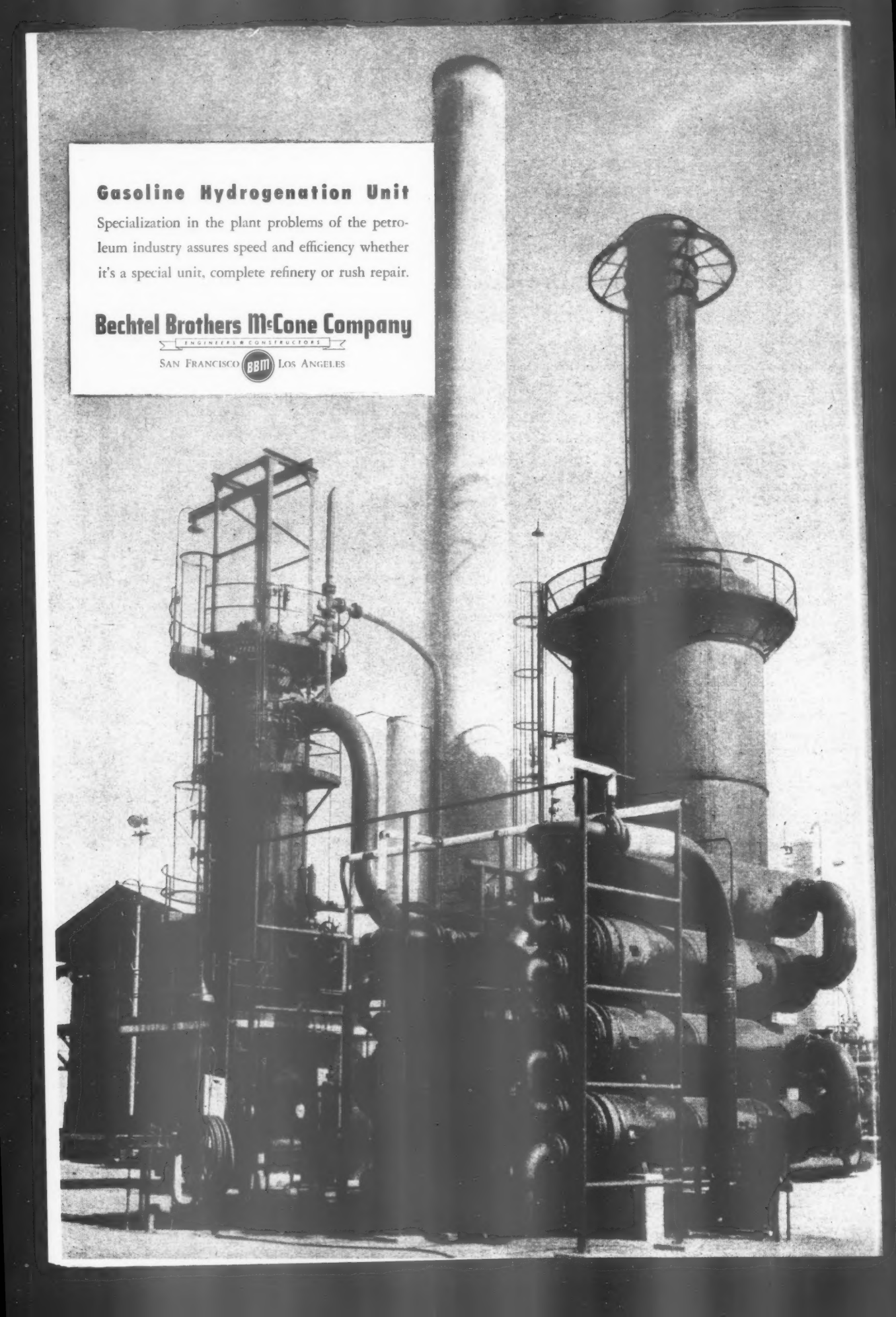
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Trends

Crude-Oil Production By States—Page 110

CRUDE-OIL STOCKS 218,355,000 bbl. as of Dec. 8—down 490,000 bbl. One year ago 220,258,000 bbl.

GASOLINE STOCKS 87,004,000 bbl. as of Dec. 8—up 1,408,000 bbl. One year ago 81,136,000 bbl.

RESIDUAL FUEL-OIL STOCKS 44,743,000 bbl. as of Dec. 8—down 1,791,000 bbl. One year ago 60,486,000 bbl.

GAS OIL AND DISTILLATE STOCKS 42,406,000 bbl. as of Dec. 8—down 1,868,000 bbl. One year ago 43,886,000 bbl.

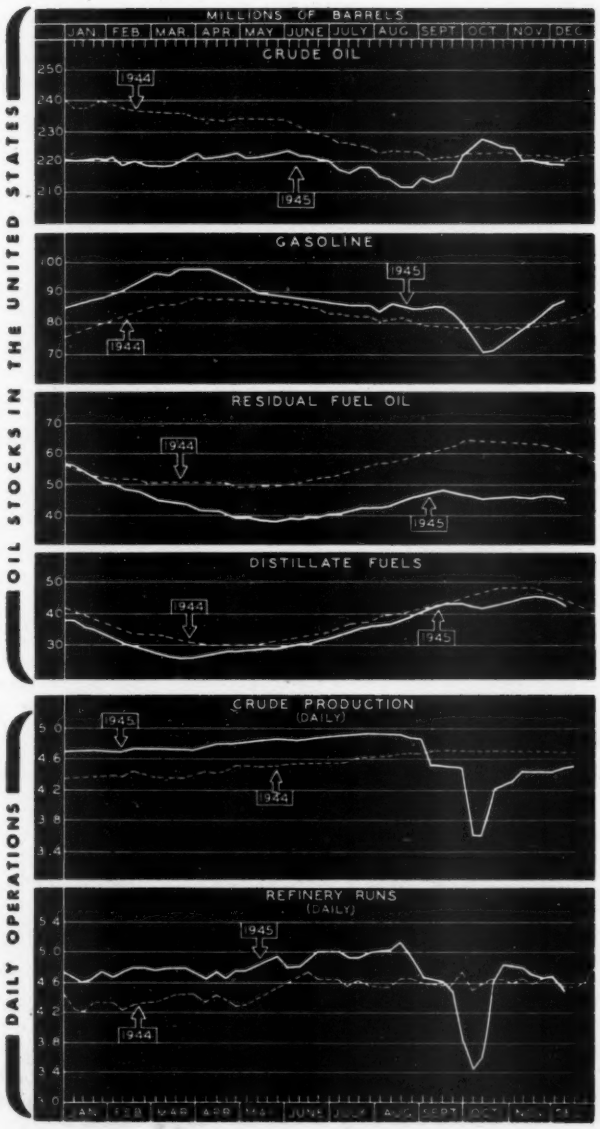
CRUDE-OIL PRODUCTION 4,508,700 bbl. as of Dec. 15—up 35,600 bbl. One year ago 4,700,030 bbl.

REFINERY RUNS 4,473,000 bbl. daily week ended Dec. 8—down 217,000 bbl. One year ago 4,595,000 bbl.

IN connection with current labor matters involving both union and nonunion policies, oil-company managements are becoming more and more interested in what are commonly called "job analyses." While it is improbable that this development in industrial relations will receive comprehensive consideration at the fact-finding panel now under way at Washington looking to the solution of immediate wage issues at refineries, it is certain that many employers will give more thought to the application of these analyses in the establishment of permanent wage and salary rates.

INTEREST in these analyses and their application is in no sense an antiunion action on the part of employers. In fact it is known that certain minor union officials at least have indicated interest in the program as developed previous to and during the early war period and recommendations of refinery managements in job evaluations were accepted in part in establishing union scales. In general, however, the matter of relative skills and experience has usually been ignored in the scales now effective including the recent increases. The general feeling of managements is that in petroleum employment connected with field and plant operations the rates for nonskilled workmen are too high in relation to the positions requiring the maximum in skills and responsibility. It is also pointed out in this connection that the scarcity of labor during the war revealed that much could be accomplished quickly in training employes for new work. In the case of some refineries it was established that women could be trained to do part of the semiskilled and skilled work formerly done by male employes. The same programs revealed that men who had been doing approximately the same work for several years could be trained for positions of greater responsibility.

IT is pointed out that this trend looking to the establishment of permanently satisfactory industrial relation is not based on temporary expediency. Its background is the establishment of courses in the various phases of industrial relations at many of the country's leading universities including the granting of scientific degrees. From this training come men and women who have the abilities which qualify them, with the aid of managements, to carry on investigations in which skills and other phases of employment are properly evaluated.



Authority of Fact-Finding Panel Challenged at Labor Parley

by Henry D. Ralph

WASHINGTON.—The Government's attempt to settle the refinery wage dispute bogged down over the union insistence on consideration of company profits and oil prices.

After a day and a half of futile discussion over jurisdiction, the wage panel recessed its hearings until Friday at which time it hopes to have answers from the secretary of labor and director of economic stabilization as to whether or not it has authority to make findings on the companies' ability to pay higher wages within existing price ceilings or their right to make wage increases the basis of a request for higher prices.

From the start the union has demanded access to company earnings statements and when this was denied by the panel the union sought to achieve the same result by indirect approach. It asked the panel to rule that it has authority to recommend whether or not a wage increase should be the basis of a price adjustment. When the panel tentatively ruled that it lacks such authority the union demanded reconsideration and the panel was forced to seek advice from higher government sources.

Chairman Frank P. Graham explained the question presented a problem of over-all government policy which is currently being studied by top officials and no answer would be ready before Friday. He asked the parties to present their cases for and against a wage increase pending this policy ruling, but both union and company representatives declined to do so until they know the issues and the rules of the game.

The union renewed its demand denied at earlier conferences on procedure that the panel subpoena the company books or obtain financial data from other government agencies. This was in effect denied when Graham announced the panel would adhere to its previously announced rules of procedure which included a statement that the parties are expected to submit data on which a full and fair report may be made and that the panel on its own initiative will use its discretion in developing any facts from government sources it considers pertinent to the inquiry.

Representatives of all companies present asserted that they would not plead financial ability to meet union demands, arguing that under rules of procedure previously agreed upon this would eliminate them from all discussion of earnings and profits.

At the opening session formal appearance was entered for only four companies — Atlantic Refining Co., Cities Service Oil Co., Republic Oil Refining Co. and Standard Oil Co. of Ohio. Some of the other seized refineries submitted written data and it was understood that representatives of still others may appear later. Frank P. Graham, panel chairman, warned that companies stayed away at their own risk, whereupon those present asserted they appeared at their own risk.

Ben Harper of Pure Oil Co. entered an appearance but later withdrew temporarily when it appeared that the question of company profits might still be open for consideration by the panel.

O. A. Knight, president, and Lindsay P. Walden, general counsel, of the union, took the position that the panel should obtain for the record all the information sought by the union, such as the refiners' earnings position, making quite a point of their claim that the Government took away the union's bargaining power when it seized the plants and broke the strike.

Sinclair Case Called "Special"

Panel member Otto Beyer asked how then it was possible for the union to have bargained with Sinclair Oil Corp. so successfully that the Navy terminated its control of Sinclair plants Sunday. The union men asserted this was a special case.

In answer to the union's questions regarding interpretation of the president's executive orders, the panel ruled that it does have the right to make findings and recommendations as to the wages which should be paid on resumption of a 40-hour work week in the seized plants.

It ruled tentatively, subject to further consideration, that it does not have the right to find that its recommended wage increase, if any, should not be used as the basis for seeking an increase in price ceilings. If adhered to, this decision apparently rules out all consideration of company earnings and would not foreclose companies from seeking higher prices if large wage increases are granted.

In its third question, the union asked if the panel has the right to recommend wage increases to assist in transition to a peacetime econany other than the three categories listed in Executive Order 9651, these being: (1) An increase in average straight-time hourly earnings since January 1941 to equal the percentage increase in cost of living since then; (2) to correct inequities in wage rates among plants in the same industry or locality, and (3) to recruit manpower in an industry designated as essential. The panel ruled that it probably has power to recommend increases under other circumstances but it would be very reluctant to go beyond the three categories listed by the president.

While company representatives did not argue the union's questions, their significance was made plain in a brief filed by Standard of Ohio. This declared that the panel is unquestionably limited to consideration of wages to be paid by seized plants on resumption of the 40-hour week and that this determination must be made within the framework of the executive orders. Since the dispute does not concern inequities among plants nor recruitment of manpower, the brief argued, there can be no other question before the panel except the increase in average straight-time hourly earnings since 1941 necessary to compensate for the subsequent increase in cost of living.

Pointing out that the Government has found that living costs have increased 33 per cent since 1941, the brief asserted that Sohio refinery workers have received four general wage increases since then amounting to a 22 per cent increment in average straight-time hourly wage rates and a further increase of 9 per cent over present rates will fully compensate for the increased cost of living. Sohio offered a 15 per cent increase, equal to 40 per cent over 1941 rates, but the union struck for a 30 per cent increase. The panel is limited to consideration of average straight-time hourly earnings and should not consider the issue of take-home pay injected by the union, the brief declared, but pointed out that a 15 per cent wage increase and a 40-hour week will give Sohio refinery workers take-home pay nearly 60 per cent higher than in January 1941, or almost double the percentage increase in cost of living.

During the controversy the union has shifted its demand from a 30 per cent increase to a flat raise of 38 cents per hour for all refinery workers. The Sohio brief contended that while this would make no difference in total wage payments it would upset differentials so that unskilled workers would have little incentive to qualify for skilled positions. The union brief justified this

shift in demand on the ground that low-paid workers need a higher percentage increase than those already in the upper brackets.

The panel's tentative decisions appeared to rule out consideration of these matters.

Nevertheless, Walden demanded that the panel either ask President Truman to subpoena company books or else obtain profit data from Government agencies such as RFC and SRE. The panel's earlier refusal to obtain the facts, adding:

"Since President Truman is relying upon public sanction, through principally a company dominated press and radio, to enforce the findings of this panel, we insist that the swollen profits, including hidden profits, be revealed to show that the union's demand for maintenance of take-home pay can be met without increasing prices or substantially reducing excess profits."

Walden submitted a 100-page brief dealing chiefly with oil workers need for more pay, beneficial national results of high wages, and the financial position of the oil industry including data on seized plants to the extent that the union could obtain information.

The Navy announced Sunday that it had relinquished control of all seized facilities of Sinclair Oil Corp. following an independent settlement with the union, following which Knight issued this statement:

"Oil Workers International Union wishes to confirm the announcement made yesterday by Harry F. Sinclair, president of Sinclair Oil Corp., to the effect that the union and company have negotiated the settlement of the recent wage dispute which caused the seizure of the company's property by directive order of President Truman. The terms of this settlement provide for an increase in the basic wage rate of all Sinclair workers represented by the union. The increase is 18 per cent. As the company average hourly rate of pay is $1.27, the average hourly adjustment will be 22.8 cents per hour. For example the rate range at Sinclair's East Chicago refinery has been from 96 cents per hour for common labor to $1.52 per hour for stillmen. With the 18-cent increase, the new rates of common labor will be $1.132 per hour and the new rate for stillmen will be $1.793.

"In addition to the above, the union wishes to announce that the National War Labor Board had just made its final decision in a case involving the union demands for shift differentials for Sinclair employes. On the basis of that differential, which is 4 cents per hour for the evening shift and 6 cents per hour for the midnight shift, the basic rates of pay for shift workers will be increased an average of 3⅓ cents per hour, in addition to the increase provided by the 18 per cent settlement."

Price-Ceiling Removal Sought to Relieve Short Fuel Supply

WASHINGTON. — An increase in the ceiling prices on kerosene on the East and Gulf Coasts was expected from the Office of Price Administration this week as a partial solution to shortage of light fuel oils.

Such action was one of a series of recommendations made to OPA by a special industry advisory committee and also by the Petroleum Industry War Council.

The special East Coast Fuel Oil Advisory committee, headed by A. J. McIntosh of Socony-Vacuum Oil Co., was appointed by OPA to determine the extent, if any, that OPA price ceilings were contributing to the shortage of kerosene and fuel oil on the Atlantic seaboard. The committee, however, went beyond price ceilings and recommended broader action, such as restrictions on exports and changes in military procurement. After two meetings in New York City the committee made an extensive report to OPA on December 6, a summary of which was released by OPA on December 12.

The McIntosh report was also discussed at some length by PIWC, following which the Council issued a statement declaring:

1. There is more than adequate crude oil production and refining capacity available to meet all currently indicated needs for petroleum products.

2. On the basis of stated OPA policy of removing price controls and letting competition regulate prices when products are in adequate supply, there is no reasonable ground for continuing to maintain price control on oil.

3. The 1941 industry prices which are the basis for present petroleum product price ceilings, were set at a time when there was need for maximizing gasoline production. Today there is less demand for gasoline and substantially more kerosene and various grades of fuel oil. However, the price straight jacket prevents the fluctuation of prices on various products from functioning in the normal manner to readjust product yields and meet seasonal and other fluctuations in consumer demand.

4. Supplying this winter's heavy demands for fuel oil and serving the interests of the American people in having adequate quantities of all needed products available at all points can best be accomplished by the prompt removal of price control on petroleum and its products.

Deputy Petroleum Administrator Davies is shown here receiving the new medal Award for Merit from President Truman in a White House ceremony in which he was cited for "exceptionally meritorious conduct in the performance of outstanding services to the United States." The citation emphasized Davies' part in organizing the government-industry combination which won the battle for oil and his work in the Anglo-American oil agreement

British Loan Will Aid Export of Oil Equipment

WASHINGTON.—Eventual complete elimination of import restrictions and exchange controls which are hampering the export of United States oil equipment and other commodities is called for in the Anglo-American financial agreement signed here December 6.

In the meantime, however, it is understood that the British Government has reconsidered its earlier refusal to permit American oil companies operating in the British empire to use dollar exchange for purchase of American-made equipment for rehabilitation of their properties. Officials of the State Department say that some of the most aggravating cases have already been cleared up and the British are now giving favorable consideration to applications for shipment of United States equipment into the "sterling area" where showing is made that delivery cannot be obtained from sources within the British empire.

Under the Anglo-American agreement the British Government agrees to remove all discriminations arising from the so-called sterling area dollar pool so that each area using sterling currency will be free to apply its balances of foreign exchange in any way it desires. This will permit Straits Settlements, for example, to allow companies operating there to purchase American goods if they have dollars available.

This promise to break up the "sterling bloc" must be fulfilled as early as practicable and not later than 1 year from the time the agreement becomes effective. The agreement has been ratified by the British Parliament but has not yet been acted on by Congress.

This reference to sterling-area controls is part of the loan agreement whereby the United States makes available to the United Kingdom a line of credit up to $3,750,000,000 which may be drawn upon any time up to December 31, 1951. The terms of the agreement also require certain other action designed to remove impediments to international trade imposed by Great Britain before and during the war.

In addition, both governments have agreed in principle to a set of proposals for consideration by an international conference on trade and employment which probably will be called for next spring. These call for eliminating or reducing tariffs and preferences, quantitative restrictions, subsidies, state trading, cartels, and other types of trade barriers. Both governments propose to begin preliminary negotiations between themselves and with other nations to develop concrete arrangements for submission to the conference. As a start, the United States has already invited 14 nations to a preparatory session on reduction of trade barriers.

This is all part of the administration's policy to promote foreign trade by progressive reduction of all sorts of barriers to imports and exports. While recognizing that war conditions made it necessary for Great Britain and other countries to impose many restrictions on foreign exchange and trade, the United States Government is insistent on forcing relaxation of these barriers as rapidly as possible. As part of this program, American tariffs probably will be reduced further by means of bilateral reciprocal trade agreements, such as those now in existence with Venezuela and Mexico which cut in half the import tax on crude petroleum.

As soon as the credit is drawn upon by the British Government the sterling exchange position should be so improved as to permit considerable relaxation in the restrictions which have hampered exports to British empire areas, because the agreement itself states: "The purpose of the line of credit is to facilitate purchases by the United Kingdom of goods and services in the United States, to assist the United Kingdom to meet transitional postwar deficits in its current balance of payments, to help the United Kingdom to maintain adequate reserves of gold and dollars, and to assist the government of the United Kingdom to assume the obligations of multilateral trade, as defined in this and other agreements."

Antitrust Suit Reinstated on Docket

WASHINGTON.—The 5-year old antitrust suit against the American Petroleum Institute and 21 major oil companies has been reinstated on the docket of the federal court in the District of Columbia by a motion by the Department of Justice, asking that a date be set for the defendants to file answers.

The motion has been docketed for hearing February 18, at which time the court will set a date for filing answers, about 60 days later.

David V. Stroop, whose appointment as assistant to the president of American Petroleum Institute was announced last week by William R. Boyd, Jr., president. Stroop joined the A.P.I. staff in 1928, and prior to his recent appointment was executive secretary of PIWC's committee on protection of petroleum facilities

The case was originally filed September 30, 1940, but formal answers were never filed by most of the defendants. Negotiations for a consent decree proceeded for about a year but were dropped after Pearl Harbor, and in July 1942 the government agreed to postpone the case indefinitely because of the war.

It is a civil suit, rather than a criminal case, and no individuals are named as defendants. No penalties are sought for past violations of the antitrust laws but the court is asked to order sweeping changes in major company business practices, and also for dissolution of the A.P.I. as "relief" for the public and competitors in the future.

Major company defendants are Atlantic, Cities Service, Consolidated, Continental, Gulf, Mid-Continent, Ohio, Phillips, Pure, Shell, Skelly, Socony-Vacuum, Standard of California, Standard of Indiana, Standard of Kentucky, Standard of New Jersey, Standard of Ohio, Sun, Texas, Tide Water, and Union. Also named are some 200 subsidiary and affiliated corporations of the major defendants.

Barnsdall Oil Co. originally was named as a major company defendant but was dismissed on a showing that it is no longer integrated. Dismissals were also entered for a couple of dozen subsidiaries, chiefly because they had gone out of existence or become inactive as a result of corporate reorganizations.

THIS WEEK

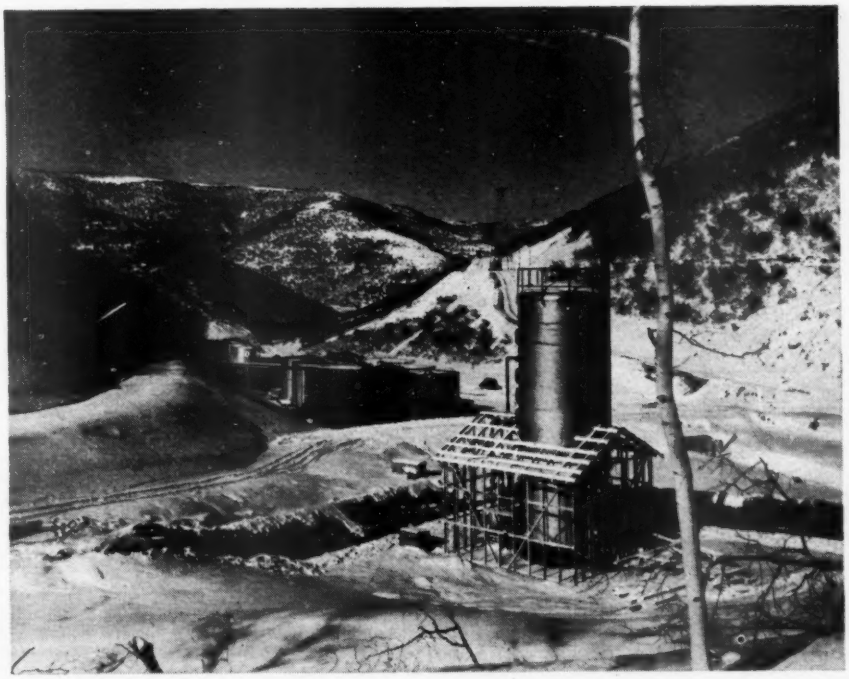
LABOR— Fact-finding oil panel strikes snags at outset of hearing. . . . Both elements demand clarification of panel's authority before proceeding. . . . Oil union insists on examining refiner's books, probably to establish precedent for later fact-finding hearings. . . . Oil companies insist profit position has nothing to do with wage issue. . . . Most companies have applied and offered increases making refinery wages 40 per cent or more above 1941 rates. . . . ¶Sinclair Oil Corp. negotiates new contract with union granting 18 per cent increase on basic 40-hour week. . . . Navy returns nine Sinclair refineries and pipe-line facilities to private management. . . . Union calls Sinclair settlement "special case." . . . Most companies had voluntarily offered 15 per cent rise before strike occurred and before properties were seized, freezing dispute. . . .

PRICES— OPA considering advisory committee recommendation for higher ceilings on kerosene and distillate fuel. . . . Advisory committee proposes higher prices to increase East Coast supplies. . . . Appeal of issue to White House by Barney Majewski fails to draw reply. . . . PIWC, in final official action, recommends abolishment of petroleum-price controls. . . . Adequacy of supplies cited to support plea for restoration of normal competitive forces. . . . ¶Refiners ignore volume demand for fuels, concentrate on more valuable gasoline. . . . Price increase for fuels, it is argued, would reverse manufacturing emphasis. . . . ¶Shell seeks to advance posting on Ellenburger sweet crude in West Texas. . . .

NATIONAL AFFAIRS— Defendants in "Mother Hubbard" oil-antitrust suit will be forced to file answers early in 1946. . . . ¶Attorney general rules WEP pipe lines may be operated by oil-company combinations— if used strictly as common carrier facilities. . . . ¶PIWC shelves decision on creation of National Petroleum Council. . . . W. Alton Jones' committee to continue exploration of industry's attitude on own initiative. . . . If plan receives predominant support, organization meeting will be called, independent of PIWC. . . .

PRODUCTION— Nation's output increases 35,600 bbl. per day with Kansas, California and Michigan chief contributors. . . . Output remains 34,000 bbl. per day below Bureau of Mines calculated demand during December. . . . ¶Interstate Oil Compact Commission hears report projecting 1946 crude output at 4,150,000 bbl. daily. . . . Same review places yield of natural gasoline and allied products at 300,000 bbl. daily—net domestic petroleum supply at 4,450,000 bbl. per day, next year. . . . Comparable 1945 output is 4,670,000 bbl. of crude, 310,000 bbl. of natural gasoline, net supply of 4,980,000 bbl. . . .

FOREIGN— Mexico will ship 450,000 tons (3,150,000 bbl.) of crude oil in Argentina in next 2 months, in partial payment for wheat. . . . ¶Venezuela reduces taxes on gasoline, enabling companies to sell at "world's lowest price." . . . Intensive exploration program assured in Venezuela in 1946 to aid companies in selecting most favorable acreage. . . . Half of holdings must be returned to government in 1947-48. . . . ¶New Colombian oil law to receive further consideration in special congressional session early next year. . . . ¶Standard-Vacuum Oil Co. commission returning from Dutch East Indies after inspecting war damage. . . . Rehabilitation will be predicated on commission's study. . . . ¶British loan will presumably free sterling areas to purchase oil-industry materials wherever available, lifting virtual embargo against United States suppliers. . . .



Already garbed in its winter mantle of deep snows, Wilson Creek, the world's highest oil field, located on the Rio Blanco-Moffat county line, northwestern Colorado, presents a picturesque setting. Its terrain is very mountainous and rugged with elevations varying from 7,800 to 8,500 ft. Snow plows keep its circuitous, mountainside road system open to permit uninterrupted field operation. At present it is the scene of drilling of the Rocky Mountain region's deepest well, now at a depth of approximately 13,000 ft. Shown is a view down one of its canyons. In the foreground a new oil treater is being installed. Visible in the background are two batteries of field tanks

Difficult Drilling and High Costs Attend Development of Rangely Field

by Neil Williams

CURRENTLY the most active spot in the Rocky Mountain region and already proved a petroleum reserve of sizeable proportions, the Rangely field in Rio Blanco and Moffat counties, northwestern Colorado, is one in which difficult drilling and completion conditions and high operating costs, prospects of slow recoveries and long-range payouts, and limited markets are factors controlling development and economic returns.

In summary of the structural and geological characteristics as they pertain to the operating practices, the field overlies the crest of an elongated anticlinal fold having a northwest - southeast trending axis. The producing horizon involved in this development is the Weber sandstone, roughly the equivalent of the more commonly known Tensleep sand of Pennsylvanian age which has received extensive development in Wyoming fields during the last several years. Oil saturation occurs in zones of varying thickness, controlled by permeability, distributed through a vertical section of approximately 600 ft. topped over the apex at depths of from 5,600 ft. to 5,900 ft. (surface elevations 5,300-5,400 ft.)

The surface structure extends approximately 20 miles long and 8 miles wide, embracing an area of about 100 square miles with an indicated closure of 1,900 ft. The present proved area covers approximately 21 square miles, extending approximately 7 miles in the northwest - southeast direction with a width of more than 3 miles at the widest point. The definitely indicated proved area, embracing acreage within the minus 1,100-ft. contour, representing a closure of 600 ft. below the crest, takes in approximately 21,100 acres. So far, no well has found water and there is no definition of the productive area in any direction.

Here is the first of several articles on the Rangely field in northwestern Colorado and other Rocky Mountain pools. Material for this and succeeding reports on operations in the Rockies was assembled during a 3-weeks' field trip by the author. Structural and geological characteristics of the Rangely field, and its history were discussed in an article by C. R. Thomas, U.S.G.S., appearing in the November 24 Journal. This and later articles by Williams will deal primarily with operating aspects of the field, development practices, and efforts of operators to adopt engineering techniques to achieve more effective and efficient results in drilling and completion of wells.

Except for the discovery well, which was completed in July 1933, but which was shut for lack of market and not reopened until September 9, 1943, all development has occurred during 1944 and 1945. The first offset to the discovery well was not started until April 22, 1944, and was not completed until August 26 of that year. Late in November, this year, there were 28 producing wells with 28 drilling rigs in operation. The number of drilling rigs is slightly below the peak of 33 which were operating about 2 months ago, but several of the operating companies have slackened their drilling program in view of the difficulties of winter work and pending the availability of more adequate equipment and more favorable conditions. However, several additional operators are entering the field with prospects of increasing drilling activity again.

The status of development and drilling activity by operating companies, as of November 25, is indicated in the following tabulation:

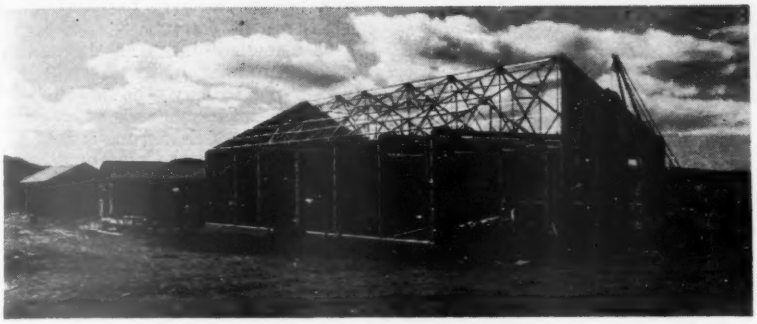
	Active locations	Drilling wells	Locations to date
Algord Oil Co.	..	1	..
California Co.	..	9	17
Continental Oil Co.	..	1	..
Idaho-Wasatch-Sharples*	1	3	3
Newton Oil Co.	1	2	1
Phillips Petroleum Co.	..	2	..
Stanolind Oil & Gas Co.	1	4	4
The Texas Co.	4	6	3
Total	7	28	28

*Idaho Refining Co., Wasatch Oil Refining Co., Sharples Co.

Drilling contractors in the field and the number of rigs being operated by them are: Loffland Brothers Drilling Co., nine; Kerlyn Oil Co., five; Parker Drilling Co., four; Brinkerhoff Drilling Co., three; Manning & Brown, three; Inland Drilling Co., Mack Drilling Co., Lafayette Drilling Co., and Newton Oil Co. (company rig), one each.

In view of the time required for drilling and completion, a rig on the average does not make more than three wells per year. However, at this rate it is expected there will be approximately 100 wells in the

One of the several new company camps under construction and supply yards in the Rangely field. View shows the general nature of the terrain. The field lies in a relatively flat basin



Permanent pump station under construction in Rangely field for Utah Oil Refining Co.'s new 10-in. pipe-line station. It will contain two 500-hp. 10-cylinder Cooper-Bessemer units

field by next spring. With two exceptions, all development is confined to the present proved limits, development of which alone is expected to require a total of 650 to 700 wells on current 40-acre spacing.

Location of the field in a remote, sparsely inhabited, cattle and sheep-range area, far removed from centers of supply and service, has been a major handicap in its development. It is 105 miles west of Craig, Colo., western terminus of the Denver and Salt Lake Railroad, which is the nearest supply point. This has necessitated long trucking and servicing hauls, which not only has increased transportation costs but frequently has resulted in delays in obtaining equipment and materials. Operators generally have been forced to anticipate requirements well in advance and so far as possible maintain more than normal stocks in the field. Heavy snows and ice-covered roads, and extremely cold weather accentuate transportation problems during the winter months.

Living conditions for field personnel also have been limited and have created problems in obtaining and keeping adequate manpower. There has been none near the field. Although the town of Rangely is in the field, it is only a small, western-type settlement with no facilities. Most of the field men stay either in crowded Vernal, Utah, about 50 miles west of the field, or at Meeker, Colo., 60 miles distant, and go back and forth daily. Some have had to live in Craig, requiring a 210-mile round trip each day. The majority of supply house and service company representatives working the field make their headquarters in the latter city. Large and modern camps now are being built in the field by The California Co., Stanolind Oil & Gas Co., and The Texas Co., the three largest operators, as well as by several of the contractors. Building of camps, which will relieve the situation and save much traveling time and costs for the field men and also the companies, has been slow because of the difficulties of obtaining materials.

Except for the long distances involved, the field actually is not hard to reach as it is only 15 miles off the main paved highway extending from Denver through Craig and Vernal to Salt Lake City. A natural rock and gravel road links the field with this highway. Lately, a typical "mushroom" oil town is springing up at the intersection of the paved highway and road to the field. There, also, large trailer camps are growing up for oil-field workers.

Well Cost Is $150,000

Wells cost approximately $150,000. Some wells in which conditions may have been more favorable than the average have cost less. On the other hand, this cost has been greatly exceeded in a number of cases. Considering not only the present limited market outlet and artificial restrictions on daily production, but also the prospect that, because of the low permeability and tightness of the producing sand, recoveries from the reservoir naturally will be slow, the high well costs present an economic problem. Development of ways and means to reduce well costs is a major concern of all operators in the field.

It has been only since last September 19 that the field has had a pipe-line outlet. At that time Utah Oil Refining Co. placed in operation its 10-in. line from the field to Wamsutter, Wyo., a distance of 152 miles, where it ties into its main line to refineries at Salt Lake City. Prior to completion of the new line, producers were dependent entirely upon trucks to move the oil with hauls either to Salt Lake City, a distance of more than 225 miles, or to Craig. Since trucks could not handle all the potential production most wells had to be shut in, all or part of the time.

Capacity of the pipe-line outlet will be approximately 20,000 bbl. daily when permanent pumping equipment is installed. Pending installation, now under way, of this equipment, portable-pumping units having a combined capacity of slightly less than 12,000 bbl. daily are being used. These consist of three pumps, each driven by a 115-hp. gas engine and having a capacity of 165 bbl. per hour at maximum discharge pressure of 1,050 psi., and one pump with a 75-hp. engine and capable of handling 100 bbl. per hour. The station is located in the low, southeast part of the field to which oil from all leases flows by gravity.

Pipe-line capacity and market outlet is allocated equally to all wells. Initial allocation, effective September 19 when operation of the line was started, was 260 bbl. daily per well. On October 1, the allocation was increased to 350 bbl. daily. On

(Continued on page 53)

Temporary pumping station in Rangely field for Utah Oil Refining Co.'s new 10-in. pipe-line outlet. It includes four gas-engine-driven pumps with a total capacity of 595 bbl. per hour at maximum discharge pressure of 1,050 psi. Permanent pumping equipment with capacity of 20,000 bbl. daily is being installed

INTERNATIONAL

Iranian Oil Production Set New Record in 1944

Production of petroleum products in Iran during 1944 by the Anglo-Iranian Oil Co., Ltd., reached a record figure of 11,521,555 metric tons (87,102,955 bbl.), according to the company's annual report.

Most of the crude oil continued to come from Haft Kel and Masjid-i-Sulaiman. A pipe line now connects the Gach Saran field with the refinery at Abadan and the rate of delivery is approximately 2,000,000 tons (15,120,000 bbl.) annually. The Agha Jari field began production in 1943.

During the first war years, the Abadan refinery operated considerably below capacity, but with greater demand capacity was fully utilized. Plant to handle 4,000,000 tons (30,240,000 bbl.) annually was added and started operating in December 1944.

Lebanese Chamber to Consider New Refineries

The agreement between the Lebanese Government and two United States oil companies for the construction of refineries near Tripoli will be submitted to the Lebanese chamber for ratification, according to the foreign press. Plants are to be completed within 5 years and facilities will be granted for the establishment of railway lines, ports, and radio and telephone installations.

Argentina Production Declines 5.6 Per Cent

Petroleum production in Argentina in the first 6 months of 1945 amounted to 1,839,401 cubic meters (11,569,832 bbl.), compared with 1,947,753 cubic meters (12,251,366 bbl.) in 1944, according to the Direccion de Minas y Geologia.

The decline of total production amounted to 5.6 per cent, that of state output 5.4 per cent, and that of private companies 6 per cent.

Permission Sought to Explore in Panama

Permission to search for oil on the Isthmus of Panama has been requested by a large United States company, according to Panamanian reports.

A 3-year contract is desired, under which exploration would be conducted by zones. If oil should be found, development would continue under new contracts.

Although prospecting for oil has been unsuccessful in the past, this new undertaking is regarded as another possibility in developing the natural resources of the country, it is stated.

Philippine Exploration To Be Resumed

The Far East Oil Development Co. and its affiliate, The Capital Co. of San Francisco, plan to resume oil exploration operations in the Philippine Islands early in 1946.

A. E. Ireland, Los Angeles, the company's manager, and Dr. Grant Corby, consulting geologist for both the Far East Oil and the commonwealth government's national development company, are returning to the islands to resume operations.

Before the war, oil indications had been encountered at 9,000 ft. but the well and machinery were destroyed by the U. S. Army to prevent seizure and use by the Japanese.

Geologists throughout the orient are awaiting results of operations at Daanbantayan, Cebu Island.

Repairs to Albanian Oil Facilities Progressing

Repairs to the damaged equipment of the Albanian oil industry are progressing; the Kucova wells have resumed production, according to the foreign press. It was hoped that half the output of crude oil could be treated locally when the third distillation plant, being restored during the summer, is in operation.

Production of oil under Italian rule is believed to have reached temporarily more than 200,000 metric tons (1,400,000 bbl.) annually.

Operators in Colombia Protest Changes in Law

Provisions for cutting the maximum concession areas by 50 per cent are drawing chief objections from Colombian operating oil companies to the proposed petroleum law which has passed the House and is before the Senate for action.

If the proposed oil bill becomes law during the special legislative session early next year, the maximum concession areas will be cut from 100,000 hectares (247,000 acres) to 50,000 hectares in the llanos and from 50,000 hectares to 25,000 elsewhere in the country.

The new oil bill lifts the ceiling on the number of concessions per person or company. The limit is now two concessions and has resulted in organization of numerous subsidiary companies by most Colombian operators in technical compliance with the regulation.

Other important provisions of the proposed oil law are summarized below: Concessions may be surrendered without drilling if exploratory results are conclusive to the petroleum industry. Otherwise the bond of 1 peso (57 cents) per hectare must be forfeited.

Payments of 1 peso per hectare in the llanos area and 2 pesos in other parts of the country are due upon signature of the concession contract. A new surface fee of 3 pesos per hectare ($1.71) is payable for surface fees throughout the 30-year commercial period. The current law applies this fee only to the exploration period.

Royalties are increased to a range of 3 per cent for grants 900 kilometers (558 miles) to 13 per cent for those within 100 kilometers (62 miles) from tidewater. These royalties are minimum and higher rates may be negotiated by the minister.

Operators are granted 6 months to adjust the area of present concession applications. Bids covering the area resulting in excess of the maximum of 25,000 hectares and 50,000 hectares cannot be accepted after 3 years, following enactment of the proposed law. This means that new operators are prohibited from soliciting excess acreage for at least 3 years if pending applications are reduced by the new law.

New Distillation Unit Authorized in Brazil

The National Petroleum Council of Brazil has approved the addition of a distillation unit with a capacity of about 1,400 bbl. daily to the refinery of the Companhia Brasileira de Petroleos at Rio Grande, Rio Grande do Sul, Brazil. The current capacity of the refinery is 1,000 bbl. per day.

Colombia Has 26 Active Drilling Operations

There are 26 active drilling operations in Colombia. Shell Oil Co. leads with 7, followed by Colombian Petroleum Co. and Socony-Vacuum Oil Co. with 6 each, Tropical Oil Co. 4, and Richmond Petroleum Co. 3. Seventeen of these operations are making hole. The 9 others are either rigging up, perforating, or testing at various stages.

FOUNDED IN 1910

BY PATRICK C. BOYLE

The OIL AND GAS JOURNAL

More About Price

LAST week we had something to say about the Government's policy of maintaining ceiling prices on crude oil in its relation to future petroleum supplies within this country. This discussion has to do with another phase of this Washington policy, the most serious menace to postwar operations now confronting the oil business.

Developments in recent weeks have shown that, while the over-all supplies of petroleum are adequate, shortages of one or more products exist in certain areas, a situation which could become serious through the remainder of the winter and later. It is apparent that refiners generally are having difficulty in adjusting their activities to old and new conditions.

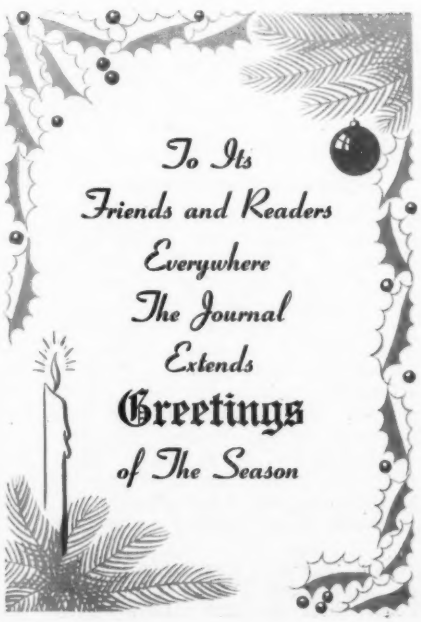
A variety of reasons are offered as to causes for this condition. Makeshift remedies are being made effective. Traced to their sources it will be found that in all cases the causes go back to effects of government controls. Many of these center in the fact that the domestic industry is still operating under price levels with minor exceptions which were effective in October 1941. Supplies are not in balance because the industry has no yardstick on which it can rely in balancing them.

The domestic refining industry has the processing fluidity and transportation facilities to see that every petroleum demand is supplied at reasonable prices. But the inevitable result of a freezing policy is either shortages in some products or excess supplies in others.

The governmental answer to this problem is the usual "more controls" by authorizing the price-fixing agency to change prices to bring about the necessary adjustments in supplies.

No group of government experts, if they had 10 times the knowledge they have, could ever arrive at prices in several refinery centers which would accurately reflect basic changes which are the natural result of variations in supply and demand. Nor could a group of industry's producers, sales managers, plant operators, accountants, and customers do a better job. Gasoline and all the other products constantly shift in price relationships because of changes in manufacturing methods and in transportation, crude oil, labor, equipment and material costs, and consumer needs, and all the other factors that enter into price movements of a commodity produced under competive conditions.

The petroleum industry needs to adjust itself to the many and in some cases opposing trends that took place during nearly 4 years of war. It can't do this until it is released from the Government's price-control policy which nullifies its contention that this industry is now free to run its own business.



Six hard workers at the Interstate Compact meeting at Wichita: W. J. Holloway, former governor of Oklahoma and chairman of the interstate relations committee; Gov. Robert S. Kerr of Oklahoma, new chairman of the compact; Gov. Andrew F. Schoeppel of Kansas, compact chairman for the past 3 years; James V. Allred, former governor of Texas; Hiram M. Dow, new first vice chairman of the compact and former lieutenant governor of New Mexico; Sam H. Jones, former governor of Louisiana

Interstate Compact Discusses Submerged Lands and Imports

by Kenneth B. Barnes

WICHITA. — A full-fledged forum on current oil and gas matters was conducted here last week by the Interstate Oil Compact Commission at its winter quarterly meeting December 13, 14, and 15. Along with the separate meetings and reports of 10 committees, there was a general session on the disputed ownership of submerged coastline lands and another devoted to imports.

Besides the general meetings, some 20 technical papers and information pamphlets were distributed on various industry matters. Several of these were reports to the executive committee and the contexts are briefed in this article.

Throughout the compact meeting repeated suggestions were made that the organization should devote attention, besides to that of conservation, to the expansion in fact-finding, statistical and development work pertaining to the economic betterment of the oil and gas industries. At a round-table discussion presided over by Olin Culberson, chairman of the Texas Railroad Commission, Walace Hawkins, Dallas, general counsel of the Magnolia Petroleum Co., gave a well supported discussion on expansion of the compact. Hawkins emphasized that problems confronting the oil industry may be more accurately evaluated by men who engage in oil production than outsiders. He said the compact could act in the capacity of an expert advisory committee.

Don T. Andrus of Bradford, Pennsylvania's representative, urged the concept of oilwell gas to be taken as an integral part of oil production, and said that handling of primary production should not let the associated gas be neglected to the point where later production is only a "secondary" procedure.

Schoeppel Welcomes Group

In his address of welcome to the 17-state group, Gov. Andrew F. Schoeppel, of Kansas, said, "The Interstate Oil Compact in the postwar era is going to grow bigger, more practical and more serviceable than ever before." A similar note was sounded by Gov. Robert S. Kerr of Oklahoma, who at the close of the meeting was selected as the new chairman of the compact. "In conserving oil and gas resources," Governor Kerr said, "the Interstate Oil Compact has made the greatest contribution of any agency in the nation."

For the state's ownership position on submerged lands, William W. Clary, first assistant attorney general of California, presented a review of the legal aspects. Clary emphasized that the U. S. Department of the Interior, until 1936, had taken a firm position that all submerged lands, coastal and inland, were the absolute property of the states. He said that the Federal Leasing Act of 1920 permitted any person to file application for oil leases on public lands, and that prior to 1936 the occasional filing of applications for oil leases on submerged coastline properties had always been denied by the Department of the Interior. After 1936, however, Clary pointed out the department's policy had changed and that the United States has "held" practically all the applications filed. In fact, he said, the policy has caused a deluge of applications for leases along the California coastline extending from Santa Barbara to Newport Beach, a distance of about 150 miles. He called this a pure title-jumping racket which resulted in: (1) The applicant's attempt to sell out to those in possession, and (2) attempts to sell small fractional interests in whatever the applications might represent. He said the inner harbor territory of Long Beach, including among other improvements the 40 - million - dollar Edison power plant, was covered by three applications, and that the Department of the Interior's position jeopardizes titles to 1,000-odd miles of the California coastline.

Warner W. Gardner, Washington, solicitor for the Department of the Interior, explained the Government position. It was plain enough that the department wishes to have its present suit, directed against the state of California in regard to tideland ownership and now pending before the U. S. Supreme Court, actually go to trial rather than be settled by congressional action. While he said he could not go into the legal aspects as a federal representative, because the suit was now pending in court, it was clear that whatever the department's former negative or passive attitude to federal ownership might be, the Government was now contending that it had title to this class of property. James V. Allred of Texas and Sam H. Jones of Louisiana, both former governors of their states, and in the past active in compact affairs, gave data pertaining to tideland oil affairs along the Gulf Coast and the chain of evidence in regard to state titles there.

Maj. B. A. Hardey, Shreveport, new president of the Independent Petroleum Association of America, talked on "A National Policy on Imports and Its Effect on the Domestic Petroleum Industry." He said the industry faces a developed and undeveloped discovered oil reserve of a magnitude greater than ever in history. He spoke of the South

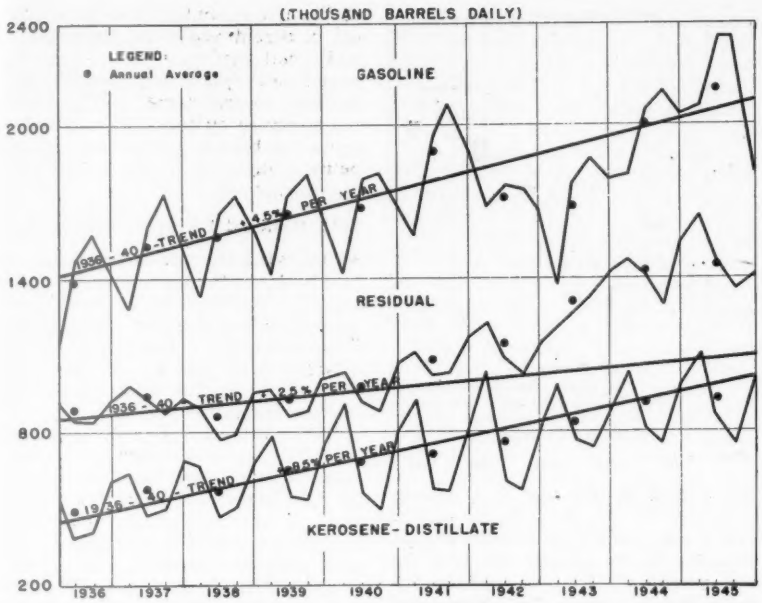


Fig. 1—In his paper, "Trends in Petroleum Operations," Dr. R. J. Gonzalez of Humble Oil & Refining Co. showed the compact the above courses in total U. S. demands (domestic and export) for major petroleum products. Of the total, gasoline accounts for approximately 40 per cent, residual fuel oil for 28 per cent, and kerosene-distillate fuels for 17 per cent. Notice that the seasonal fluctuations in gasoline are counteracted by those of the residual and kerosene-distillate fuels. War demands, such as that of the Navy, caused the "jump" in rate increase for residual fuel

American oil expansion during the war, which increased more than 400,000 bbl. daily, and the Middle East oil area, which now has indicated reserves of some 26 billion barrels, and the increase in the American tanker fleet. The American tanker fleet is now composed of 763 ships, totaling 11.4 million tons, an increase of 250 per cent in number of ships and 350 per cent in tonnage. Hardey cited the reasons why the United States is now a high-cost producer, including high wages, taxes for government and educational support, other operating factors. He recommended that the State Department arrange for hearings on the question of imports of petroleum and the products thereof, where forthright evidence and full presentation of all data could be made.

McClure on "Physical and Market Waste"

H. M. McClure, Alma, Mich., president of the National Stripper Well Association, covered the physical conservation of oil and gas and present economic problems. On the latter, the highlight of his talk was in contrasting the low price of crude oil, roughly ½ cent a pound, with the increases in prices of other staple commodities. He produced on the speaker's stand a small box of cotton, a package of butter, a bag of peanuts, and laid these alongside a bottle of crude oil, stating what the federal Government had done to lift price ceilings on these other commodities to get them up to parity. Oil, of course, has not changed in price during or since the war. McClure's examples of these other commodities, as well as steel, lumber, etc., showed the startling disparagements against the oil industry.

Trends in Petroleum and 1946 Forecast

Dr. R. J. Gonzalez, Houston, of the economics advisory committee of the compact, presented the paper, "Trends in Petroleum Operations." Bringing out that, although, except for the depression years of 1930-1932, petroleum consumption has decreased in only 3 years in the last quarter century (1921, 1938, 1942, then only by 1 or 2 per cent), Gonzalez said that the industry was so accustomed to steadily expanding volume that the decline indicated for 1946 presents difficult problems. The total anticipated requirements of about 4.8 million barrels daily will be about 10 per cent less than in 1945. This will be the largest decline in the history of the industry, exceeding the 9 per cent of 1932. The maximum range of fluctuation is predicted to be between the production peak of 4,890,000 bbl. daily in July 1945, and a low point of about 4,200,000 bbl. early in 1946. Since this change will be concentrated to a large extent on the areas that were called upon to supply much additional oil for war, the greatest impact will be felt in Texas and California, although the problem also will be general.

The lower production in 1946 will mean a sharp increase in the unit cost of producing oil, both from the fixed costs involved as well as because of advanced wage rates, and the report stated the cumulative influence will result in production costs much higher than those prevailing for 1944-1945. The report stated that this development, together with the high replacement cost of crude oil, provides convincing proof for the need of increase in ceiling prices on crude oil and refined products, or the complete removal of such ceilings at an early date.

While the 1946 outlook is a temporary outgrowth of the war, the Houston economist gave a bright picture on the over-all or long-time trend. Average growth during 1936-40 for distillate-kerosene has been 8.5 per cent annually. Gasoline increase has been 4 per cent annually, trend for residual fuel 2.5 per cent (see Fig. 1). Gonzalez also referred to the forecast of the PAW and the PIWC economics committee as to the demands for the major products in 1946, those being about 10 or 12 per cent under the 1944 record.

The chart, "The U. S. Demand, Supply and Production of all Petroleum Liquids," is given in Fig. 2. For the over-all period 1936-40, the average rate of increase demand is 5 per cent annually.

Petroleum stocks.—Downward trend in petroleum stocks given in the report reflect the withdrawal of about 100 million barrels since 1941. In California the reduction of 70 million barrels has cut stocks in half the past 4 years. Stocks east of California during the same time dropped only some 30 million barrels or 7 per cent. Stocks of all oils at the end of this year will be equivalent to about 100 days' supply in relation to the anticipated demand for 1946, a level stated to be relatively satisfactory for the nation as a whole, although some areas may acquire somewhat larger stocks for efficient operation.

Imports and exports.—Petroleum exports have shown a substantial increase to the peak of about 700,000 bbl. daily for the second quarter of 1945 compared with 360,000 in 1936. The sharp recent decline is expected to continue in 1946. The trend may become even more pronounced as domestic requirements increase and in relation to ability to produce efficiently, and as foreign resources are developed to compete for foreign markets. Imports this year will be about 300,000 bbl. daily, 55 per cent as much as exports. During the war, exports increased to a greater extent than imports. Gonzalez said it is significant that the residual fuels are expected to account for 40 per

cent of the 1946 imports because this low-priced product, which generally sells for less than crude oil, permits realization of higher valued products from domestic crude.

Production.—Total crude oil and natural gasoline for 1945 will average nearly 5 million barrels daily, exceeding 1936 and 1941 by 60 per cent and 22 per cent, respectively. Natural gasoline output has nearly tripled in the past 9 years, approximating 310,000 bbl. daily in 1945 as against 117,000 in 1936. The gain in large part is attributable to cycling plants which now average about 100,000 bbl. daily. Principal expansion has been in the Gulf Coast with Texas increasing from 34,000 bbl. daily in 1936 to 145,000 in 1945; the Louisiana figures being 5,000 to 35,000. California has had a steady gain. In the crude oil classification, Texas and California produced in 1945 approximately 50 per cent more than they did in 1940. Louisiana, Kansas, and Mississippi have shown substantial increases while Oklahoma, New Mexico, and the eastern states have declined.

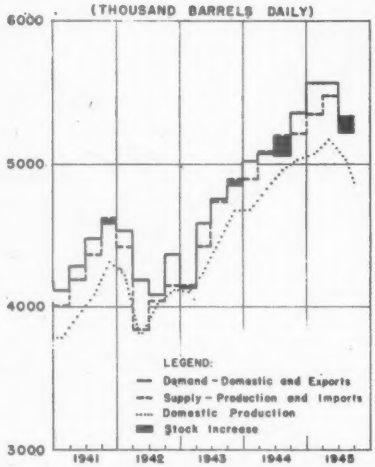


Fig. 2—Back in 1936 total U. S. demand was 3,000,000 bbl. daily. In the start of 1941 it was a little over 4,000,000 bbl. Dr. Gonzalez told the compact demand in the first quarter of 1945 ran 5,575,000 bbl. daily, that the average 1945 demand will show an increase of 22 per cent over 1941 and 60 per cent over 1936

Adequate Gas Supplies in the East This Winter

"Gas Supply in the Appalachian Area, Winter 1945-46," was presented in a report to the executive committee by H. J. Wagner, chief of the gas engineering section of Public Service Commission of West Virginia.

Wagner pointed out that increasing demand during the early war years was met by the eastern gas wells being used every day and by reducing line pressures to the lowest points possible. Sometimes vacuum conditions prevailed at the well heads. The 45,000 gas wells in the Appalachian area produced 520 billion cubic feet of gas in 1943, an average of 32,000 cu. ft. per well per day. With the small size of the wells and with temperature fluctuations from 100° in the summer to below zero in the winter, it was stated that the underground storage pools are a very vital part of Appalachian gas operations. During the 1944-45 winter 15 companies operated 40 different storage pools in the area. Withdrawals from November 1944 to March 1945 totaled 18.5 billion cubic feet. Two new storage pools have been developed this year. Gas stored underground in the 42 pools as of November 1, 1945, was estimated to be 77 billion cubic feet. Total deliverability of the stored gas was placed in excess of 500 million cubic feet per day for the November 1 conditions.

Wagner said the additional facilities recently installed by Panhandle Eastern and by Tennessee Gas & Transmission will make available 110 million cubic feet per day of additional gas by late this year. This, coupled with the lessening of demand due to the end of the war, new gas wells drilled in West Virginia and Ohio, and the increased volume of gas in underground storage, indicates that supplies in the Appalachian area will be adequate to meet requirements during the winter.

The report, "Natural Gas Industry in California," to the executive committee by Roy M. Bauer, gas supply supervisor for Southern California Gas Co., included pertinent data on conditions in that state.

Oilwell gas has been the source of nearly all of the California natural-gas supply until recent years, although the Rio Vista dry gas pool is now an important part of the total. Bauer said that with the production of oil-well gas being quite constant, the fluctuating load demands are met not only from the dry gas pools, but also from both above-ground and under-ground gas storage. An example of an extreme peak day in the Southern California area is given where the daily demand totals 715 million cubic feet per day to the 1.05 million customers connected to the systems.

The three underground storage projects are Buena Vista Hills (1928), La Goleta (1939), and Playa del Rey (1943). Input to storage normally is discontinued about November 1. This year maximum input rates to under-ground storage were 105 million cubic feet daily. The dependence in large part upon oil well gas for supply, together with close cooperation between producers, gas companies, and state agencies, has resulted in the utilization of all except something less than 2 per cent of the net formation gas withdrawals in recent years. Construction of additional facilities will reduce the very small unconserved amount still further. Repressuring and pressure maintenance during 1945 resulted in some 89 billion cubic feet of gas being reinjected to the oil-producing formations.

1944 National Stripper Well Survey

Following the last previous survey (1942) presented at a former meeting, E. G. Dahlgren, technical secretary for the compact, and George Pasquella, engineer for the National Stripper Well Association, presented a detailed 30-page report to the executive committee.

In the 1944 survey, a stripper well is defined as a well whose production expenses approximate income, so that under this definition a deep well with substantial production may be classified as a stripper well. The authors reported that of the 412,851 U. S. producing wells, there were 296,388, or 71.8 per cent in the stripper classification. In 1944, it was calculated, these stripper wells produced 12.9 per cent of the total U. S. production. Average daily production per well was 11.1 bbl. for all wells, and 2.0 bbl. for strippers.

Stripper wells in 1944 reached an all-time high, the number being 3,107 more than in 1942. Production was some 14 million barrels more from the strippers than in 1942. Abandonments, however, were 1,141 fewer than in 1942, and the recoverable oil left in the ground under the 1944 abandonments was 34 million barrels in contrast to 44 million left by 1942 abandonments.

On secondary recovery, data were presented as to estimated additional reserves which may be recovered from stripper wells under different price increases, as follows:

Increase per barrel	Barrels
25 cents	337,031,550
50 cents	979,728,575
75 cents	1,651,815,950

The authors emphasized that a substantial price increase in oil will be necessary to recover the approximate 3 billion barrels of U. S. oil that can only be obtained by secondary methods.

New Air Route Covers Oklahoma-Texas Oil Area

Inauguration of air service between Tulsa and Texas and New Mexico oil areas has been set for February 15. The new route will serve Tulsa, Oklahoma City, Wichita Falls, Lubbock, Tex.; Hobbs and Carlsbad, N. M.

The service is being initiated by Continental Air Lines, and a party of Continental officials will make a survey trip over the new route this week.

Drilling Difficult In Rangely Field

(Continued from page 45)

November 1, it was reduced to 325 bbl. daily. With the latter reduction, however, the initial allocation of 260 bbl. daily, effective September 19, was made retroactive to the dates of completion of the respective wells. Thus, in addition to the current allocation of 325 bbl. daily, all wells completed prior to September 19 and prevented from producing as much as 260 bbl. daily up to that time because of lack of market outlet are being permitted to make up, over a 3-month's period, any difference in allowable and their actual production from date of completion.

At the end of 3 months, with all back allowable made up, all wells again will be on an equal daily allocation. With no increase in outlet or market, the allocation necessarily will be steadily decreased as the number of wells completed is increased.

Wells do not have large productive capacity because of the slowness with which the reservoir gives up oil. Initial production of the largest well so far completed was estimated at 1,000 bbl. per day through open 2-in. line. Usually, well potentials are within the range of 200 to 600 bbl. daily, depending on the extent of porosity in the producing section and the permeability of the formation.

Production by Natural Flow

All production so far has been by natural flow restricted by tubing chokes varying from ¼-in. to ½-in. in diameter. Working pressures on the tubing run from 175 to 250 psi. Shut-in casing pressures while flowing through tubing build up to 500 to 1,075 psi. Reservoir pressure is approximately 2,700 psi.

Because of the tightness of the formation, it has been necessary to resort to shooting in an effort to open the zones of permeability and increase the potential productivity of wells. A particular problem is prevention of mudding up and sealing off the permeable zones or "logging" the sands with water infiltration while drilling the section. This has called for extensive use of mud acids to clean the face of the formations. These phases of operation, and the practices being developed, will be discussed more specifically in a subsequent article.

So far, relatively little is known of the reservoir conditions governing production and potential recoveries. However, operators lately have taken steps to organize an engineering committee to obtain the necessary information and study the field. With H. A. Stewart, division manager of The Texas Co., Denver, as temporary chairman; J. J. Zorichak, until recently assistant director of production for PAW, District 4 (Rocky Mountain region), has been employed as engineer.

No evidence has been given of a water drive. If there is such a drive, it is assumed to be very inactive, possibly retarded by impermeable calcarious or arkose depositions in the formation surrounding the limits of oil saturation. For the present, operators are inclined to the belief that the drive is entirely by gas in solution. There is a gas cap but this is relatively small in area, being above a subsea depth of 305 ft., which is less than 75 ft. below the top of section at the highest point.

Discovery of the gas cap came when a structurally high well, following the customary procedure up to that time of setting the oil string on top the producing formation before drilling in, was completed with a gas-oil ratio of 15,000 cu. ft. per barrel. Approximately $40,000 has been spent by the owners in reworking the well to shut off the gas. Since then the gas-oil content has been fairly definitely defined through a succession of drill-stem tests in various wells drilled around the area. As a result all wells now are drilled below that contact before setting casing and drilling the remainder of the section. Ratios in these wells do not exceed 250 to 300 cu. ft. of gas per barrel.

ANALYSIS OF RANGELY CRUDE OIL
GENERAL CHARACTERISTICS

Specific gravity	0.856
Per cent sulfur	0.74
Saybolt universal viscosity at 70° F.	64
At 100° F.	47
A.P.I. gravity	33.8°
Pour point below	5° F.
Color	Brownish green
Base	Intermediate

Extent of Reserves

Reserves are variously estimated from 10,000 to 20,000 bbl. per acre, although the majority of operators are inclined to a figure of from 12,000 to 15,000 bbl. For the present proved area of approximately 21,000 acres, this would make a total reserve of between 252,000,000 and 315,000,000 bbl.

Definite information of the distribution of saturation and permeable zones within the producing section has been lacking because of the difficulties and costs of cores. So far only two wells have cored the entire section, and only in a few other wells have parts of the section been cored. To core the entire section costs from $35,000 to $40,000 which is in addition to the normal cost of a well of approximately $150,000. On this basis it is prohibitive for any one company alone to core enough wells to give the desired information. With the formation of the engineering committee, however, a plan now is being considered whereby key wells, distributed among the different operators, will be cored and the resulting information made available to all operators. Thus the information for the field as a whole will be obtained with no single company being required to core more than one or possibly two wells.

High coring costs are occasioned by the extreme hardness and tightness of the formation. From 60 to 70 core heads are required per well, and sometimes it is not possible to make more than a few inches a day. Since all rig time after setting the oil string is charged by the contrac-

DISTILLATION, BUREAU OF MINES HEMPEL METHOD

Distillation at atmospheric pressure, barometer, 636 mm. First drop, 50° C. (122° F.)

Fraction No.	Cut C°	Cut F°	Per cent	Sum per cent	Spec. grav. 60/60° F.	°A.P.I. (60° F.)	Cloud test °F.
1	50	122	...	....	....	....	...
2	75	167	1.8	1.8	....	....	...
3	100	212	3.6	5.4	.706	69.9	...
4	125	257	5.2	10.6	.729	62.6	...
5	150	302	4.0	14.6	.751	57.0	...
6	175	347	5.3	19.9	.769	52.5	...
7	200	392	4.7	24.6	.786	48.5	...
8	225	437	5.0	29.6	.803	44.7	...
9	250	482	6.2	35.8	.820	41.0	...
10	275	527	7.9	43.7	.836	37.8	...
Distillation continued at 40 mm.—							
11	200	392	2.0	45.7	....	....	...
12	225	437	6.0	51.7	.869	31.4	48
13	250	482	6.7	58.4	.879	29.4	60
14	275	527	6.0	64.4	.891	27.3	89
15	300	572	7.2	71.6	.911	23.9	153
Residuum	...	...	25.8	99.9	.943	18.6	

Carbon residue of residuum, 7.7 per cent; carbon residue of crude, 1.9 per cent.

SUMMARY

Light gasoline—	Per cent	Spec. grav. (60/60 °F.)	°A.P.I. 60° F.	Viscosity (sec.)
Light gasoline	5.4	.706	68.9	.....
Total gasoline and naphtha	24.6	.747	57.9	.....
Kerosene distillate	11.2	.812	42.8	.....
Gas oil	14.5	.849	35.2	Below 50
Nonviscous lubricating distillate	13.0	.864-.895	32.3-26.6	50-100
Medium lubricating distillate	7.3	.895-.923	26.6-21.8	100-200
Viscous lubricating distillate	...	.....	.....	Below 200
Residuum	25.8	.985	16.2	.....
Distillation loss	26	.....	.....	.....

tor at a rate of $650 per day, the costs of coring mount rapidly.

Over-all drilling and completion time without any coring has been running from 100 to 140 days. Lately, because of the better understanding of conditions and development of appropriate practices, the average time has been substantially reduced with wells currently being completed within 90 to 100 days, barring excessive difficulties. The record to date has been 76 days.

Various factors are involved in drilling time, including the general hardness of the lower formations which consumes bits and materially slows up drilling, difficulties in fighting loss of circulation in the fractured shale section in the upper part of the hole, and complications in drilling the producing section and completing the wells. Often about as much time is required to drill the producing section (about 600 ft.) and completing the well as is spent on the rest of the hole. Adoption of methods for overcoming these difficulties and reducing drilling and completion time as the major factor in cutting total well costs constitutes a matter of major concern. These phases of operation and the practices involved will be discussed in detail in a later article.

Crude produced at Rangely comes under the classification of the "black" oils which are characteristic of Permian and Pennsylvanian (Embar and Tensleep-Weber) fields of the Rocky Mountain region. However, this oil is much above the average, both in gravity and general quality. A complete laboratory analysis of typical Rangely crude is presented in an accompanying table.

Although, as previously stated, the present movement and demand for this oil is westward by way of the Wamsutter junction of the new Rangely 10-in. line with Utah Oil Refining Co.'s main line to Salt Lake City, it is proposed that later, when the market justifies, the oil will be moved both eastward and westward. The Salt Lake City main line has its eastern terminus in eastern Wyoming, near Fort Laramie, where it can connect with Stanolind Pipe Line Co.'s main system to Freeman, Mo., and points east or with other systems to refineries at Denver. In the past this line has been supplied with crude from Lance Creek and other eastern and southeastern Wyoming fields. However, with Rangely and other northwestern Colorado fields able to supply the Salt Lake City market, and with the former crudes supplying the line being diverted to other outlets, oil movement in that portion of the Utah line eastward from Wamsutter junction can be reversed to handle the increasing Rangely production when market outlets arise.

Officers and committee chairmen of the Rocky Mountain Oil and Gas Association, elected at the recent annual meeting at Casper, Wyo. Front row: Glenn Nielsen, Husky Refinings Co., Cody, Wyo., public lands committee; J. F. Cullen, Stanolind Oil & Gas Co., Casper, taxation committee; E. J. Sullivan, E. T. Williams Oil Co., Denver, vice chairman, legal and legislative committee; H. O. English, Casper, executive secretary; James Donoghue, Mackinnie Oil & Drilling Co., Denver, first vice president. Back row: H. H. Healy, Ohio Oil Co., Casper, legal and legislative committee; Paul Stock, independent, Cody, Wyo., president; Fred Goodstein, Trigood Oil Co., Casper, second vice president; H. P. Macauley, Continental Oil Co., Denver, public relations committee; J. N. McIntire, Northern Utilities Co., Casper, natural-gas committee; Carroll Kirk, Kirk Oil Co., Frannie, Wyo., production committee. Others not present are: R. B. Curran, Carter Oil Co., Billings, Mont., second vice president; Gilbert J. Mueller, Argo Oil Co., Denver, treasurer, and Harry Chapman, Carter Oil Co., Billings, vice chairman for Montana, legal and legislative committee

DEATHS

William S. Fitzpatrick, at one time chairman of the old Prairie Oil & Gas Co. board and later vice chairman of Consolidated Oil Corp., died December 15 at Brownsville, Tex., where he had lived since retiring. He became chairman of the Prairie board in 1923 when J. E. O'Neal retired as president of the company. As a young man he was a prominent attorney in Kansas and he joined the Prairie organization as general counsel.

D. L. Goldstein, Oil City, a producer in the Pennsylvania Grade area for several years before his retirement in 1941, died December 9.

E. H. Roemer, 84, Rocky Grove, Pa., employed for several years by Atlantic Refining Co. at its Eclipse works, died in a Franklin hospital December 9.

William B. Sutton, 70, retired member of Magnolia Petroleum Co.'s legal department, died December 15 in Dallas. Sutton joined the legal staff of Magnolia in 1932. In 1918 he assumed the duties as manager of the land department of the Prairie Oil & Gas Co. in Eastland, Tex., and in 1927 he joined the Vacuum Oil Co. in the same capacity. From Vacuum, he went to Magnolia, where he served until his retirement in 1940.

Charles von Weise, 79, attorney, oil man, and civic leader, died at his home in Ardmore, Okla., December 13. Services were conducted December 15.

William R. Deatrich, 45, former manager of Pittsburgh Pump Co. in Tulsa, died December 12 at his home in Muskogee, Okla.

Dana Hogan, 54, president and general manager of Hogan Petroleum Co., died December 14 in a Los Angeles hospital. A pioneer oil man in Southern California, Hogan started with American Petroleum Co. as field man in 1913, after his graduation from University of Wisconsin. He was credited with the discovery of the Mountain View oil fields, east of Bakersfield, and later he founded the San Joaquin Valley Oil Producers' Association, and served as its president until his death.

Orville F. Macon, 57, independent oil operator, died December 16 in Muskogee, Okla. Funeral services were held December 18 in Tulsa.

Holcomb B. Latting, Sr., 55, attorney and tax counsel for Skelly Oil Co., died December 16 at his home in Tulsa.

FR

Season's Greetings

"I COMMEND MY FRIENDS, AND, WITH THEM, THE INTERESTS AND HAPPINESS OF OUR DEAR COUNTRY, TO THE KEEPING AND PROTECTION OF ALMIGHTY GOD."

GEORGE WASHINGTON 1783

FRED E. COOPER • • • ALLIS-CHALMERS

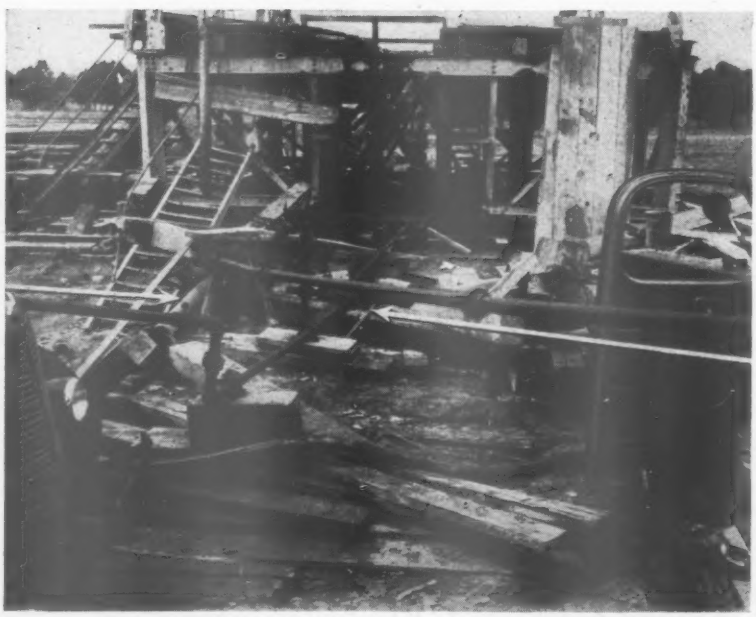
SELECTIVE ACIDIZATION PROCEDURES

CARTHAGE FIELD RESULT

by Neil Williams

Acidizing dual-zone well in Carthage field. Acid is being pumped into annulus through casing wing connection (lower left) to treat upper zone. Later, connection will be switched to tubing wing to acidize lower zone. Field superintendent is watching pressure gage on casing to note when formation is broken

Below—Multiple acid truck job showing manifolding of pump discharge lines to well. Four acid trucks with trailers are operating simultaneously, with others being held in reserve. Approximately 14,000 gal. of acid were injected in this well



THREE of the four producing horizons of the Carthage gas field in Panola County, eastern Texas, consist of oolitic limestone formations in which acid treating of wells is a factor in developing maximum productive capacity. Since well potentials are a basis for allocation of allowable production, incentive is given for establishing the greatest productive capacity possible when completing wells. This has led to an acidization race among some operators in which relatively large volumes of acid have been utilized in many cases in attempts to increase the permeability of producing formations. Lately, however, the adoption of methods by which more effective placement of the acid can be attained, rather than increasing the volume, is receiving the consideration of operators.

In this, cognizance is being taken of the fact that within individual producing horizons there may be zones or levels of different permea-

AT IN Greater Productivity-Larger Ultimate Recovery

bilities. When acidizing the entire section at one time there is the tendency for the acid to enter only the more permeable zones so that the relatively tighter zones, in which treating is most needed, do not receive their proportionate share of the acid. Consequently, the latter zones are not opened to their fullest advantage and may be left without contributing toward increased well productivity. Through application of selective acidization practices now being initiated in the field it is expected that the acid placed will be utilized more effectively in treating such zones, and attaining greater productivity and increased ultimate recoveries.

Determinations of zones for introduction of acid are being made by means of the Dowell Electric Pilot, an electrical fluid-interface locator.[1] This is the first application of this apparatus in connection with selective acidization of gas-bearing sands. Previously, it has been operative only where there has been an oil column to hold the top or bottom level of the acid at the desired points in the borehole. Its ability to locate the acid level in the hole depends upon the presence of a nonconductive fluid, such as oil, to prevent completion of an electric circuit to the surface until the acid, a conductive fluid, reaches the desired level that will contact the electrodes and complete the circuit. In the application at Carthage, where the production is gas, the apparatus has been adapted to function with a column of fresh water, instead of oil, used in the annulus to hold the acid level.

General completion procedure and the reservoir conditions have a direct bearing on practices adopted.

With few exceptions all wells now are being completed in two zones. The four zones represented in dual completions follow:

Zone—	Approx. avg. depth (ft.)	Typical reservoir pressure (psi.)	Type formation
Hill	4,900	1,800	Oolitic limestone
Upper Pettit	5,600	2,700	Oolitic limestone
Lower Pettit	5,900	2,700	Oolitic limestone
Travis Peak	6,200	2,400	Sandstone

In each zone, porosity is the controlling factor for productivity. This varies greatly by zones from well to well and is not coincident in all four zones. Consequently, zone combinations in which wells are completed differ over the field. The most widely distributed porosity exists in the Upper and Lower Pettit zones, in which most wells are now being completed. Productive porosity in the Hill zone is largely limited to a sector extending around the north, northeast, and east sides of the structure. Travis Peak porosity appears fairly extensive but since this horizon so far has offered the least productivity, only a few wells have been completed in it.

General Procedure

General procedure is to drill all wells into the Travis Peak to determine the porosity and potentialities of this zone, set and cement casing on bottom, and then, after squeeze cementing between the two zones to be produced, the casing opposite them is gun perforated for completion. When the Upper Pettit is involved, either as the upper or the lower productive zone, it also is considered good practice to squeeze above it as a precaution against water from the Gloyd sand which lies several hundred feet above. The water flow in the Gloyd sand is particularly strong and may work down behind the pipe into the Upper Pettit zone, especially when pressures in the latter become somewhat reduced. The water in the Gloyd sand also presents a hazard for the Hill zone, which is only 50 to 75 ft. above, and when that zone is to be produced it is necessary to provide a good squeeze job in the interval between them.

Of interest in connection with squeezing practices in this field is the recent use of plastic in several wells. In one late well this material was used exclusively, replacing cement not only for the initial "cementing" of the production casing string but also for a succession of squeeze jobs. Its use is expected to prove especially advantageous in squeezing the interval between the

Some of the acid-pumping trucks used on 14,000-gal. acidization job on two-zone well being completed in Carthage field. Others waiting to take their turn are not shown

Gloyd water sand and the Hill zone as these upper formations are extremely unconsolidated and do not hold up, making it difficult to obtain a good cement job. With about 200 gal. of plastic squeezed into that interval satisfactory results have been realized.

Various types of packers, both circulating and noncirculating, are being used to seal the tubing-casing annulus between the two producing zones. With a noncirculating type packer, it also is necessary to have some form of closable opening, such as a side-door choke or circulating valve in the tubing above the packer to permit circulation and unloading the annulus above that point when the packer is set.

When a circulating packer is run, the side openings in the tubing above the packer are not needed unless the upper zone to be produced through the annulus is the Hill formation. Either of the two Pettit zones is capable of coming in under its own pressure after the drilling mud in the hole is displaced, or partially displaced with water, which is done by circulating around the packer before it is finally set and closed. However, the Hill zone does not have sufficient pressure to unload the remaining column of water in the annulus, and a means must be provided for flowing a lower zone temporarily through the annulus above the packer until that part of the hole is cleaned. The Travis Peak zone also does not have sufficient pressure to unload itself, but since, if involved in completion, it always would be the lower formation and produced through the tubing, it can be brought in by swabbing.

General practice is to set the packer from 60 to 90 ft. above the lower zone to be produced with the circulating valve or side-door choke installation as close above the packer as practical, usually about 30 ft. By placing the ports low, the annulus can be cleaned more completely and effectively than otherwise. Tail pipe below the packer is run to bottom to set the packer.

Variation in Procedure

The procedure in acidizing varies somewhat in different wells depending on the permeability conditions of the producing formations. Where both zones in a well have good permeability with practically no difference between them they may be acidized either one at a time or simultaneously. In neither case is excessive pressures probable on either side of the packer. It generally is preferable under such circumstances to acidize one zone at a time, as a dual - simultaneous job requires a more complicated hookup and considerably more pumping capacity and other equipment.

When one of the two formations in a well is slightly less permeable than the other and reservoir pressures are approximately the same, it usually is considered better to acidize both at the same time. By this method, pressures while pumping the acid are fairly well equalized below and above the packer. In the case of either of the Pettit zones, the pressure built up against the face of the formation and the packer while breaking circulation to introduce the acid often may go as high as 5,100 psi., possibly more. This is based on a shut-in reservoir pressure of 2,700 psi., plus about 400 psi. pressure exerted by the weight of the water column, plus about 2,000 psi. pump pressure which might be required to break circulation. Were this pressure to be exerted on one side of the packer, particularly the lower side, without compensating pressure being built up on the other, differential pressure might be created that would cause the packer to give way or result in channeling.

If, however, the upper formation is substantially more permeable than the lower, and especially, as in the case of the Hill zone, if the reservoir pressure is appreciably less, the practice usually is to acidize it first. When this is done, the annulus, through which the upper zone is to be produced, is closed after the formation is acidized, leaving the column of fluid in the annulus under pressure to serve as a cushion on top the packer and to minimize the differential pressure built up when acidizing the lower zone. Under the circumstances, the pressure built up on top the packer while acidizing the upper formation first would not build up an excessive pressure differential over the pressure below the packer.

Pressure exerted by this cushion on top the packer in case of the Hill zone would amount to about 3,370 psi. This is based on a shutin reservoir pressure of 1,800 psi., plus about 370 psi. pressure exerted by the weight of the fluid column, plus about 1,200 psi. pump pressure ordinarily required to break circulation. If the pressure exerted on the lower formation being acidized is as much as 5,100 psi., the differential is only about 1,730 psi., which is not sufficient to allow the bottom pressure to push up the packer or channel. The differential pressure would be still less if the upper zone being acidized is the Upper Pettit.

After the formations are acidized, both tubing and annulus are opened to allow the wells to come in. If the formations are the Pettit zones, they will clean themselves under their own pressure, as previously stated. If the upper formation is the Hill zone, the side ports in the tubing will have to be opened to allow the gas from the lower zone to enter and clean the annulus. When the annulus is cleaned and the upper zone blows in, the ports are closed again and the two formations produced separately.

Circumstances are somewhat different for application of selective acidization. It is not feasible to acidize selectively the upper formation. To do so would necessitate killing the lower zone and thus mudding up the face of the formation and

(Continued on page 66)

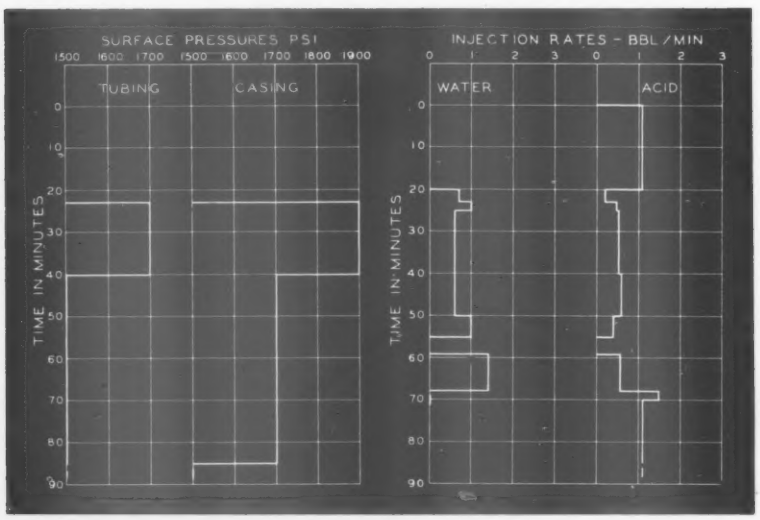
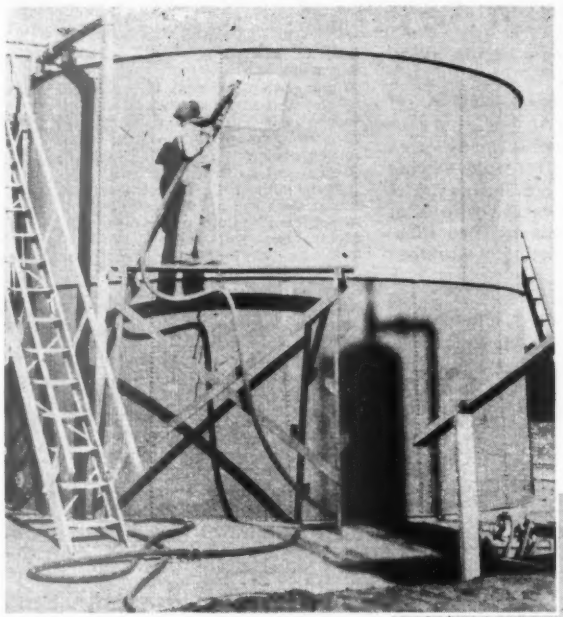
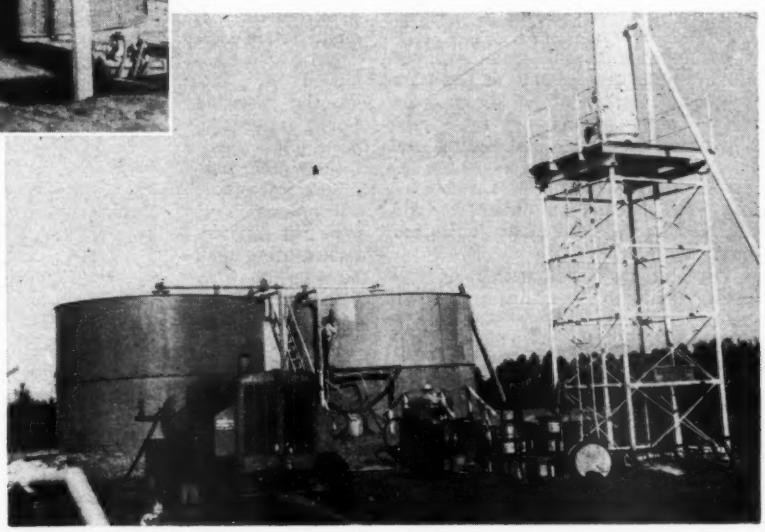

SURFACE PRESSURES PSI
1500 1600 1700 1500 1600 1700 1800 1900
TUBING
CASING
INJECTION RATES - BBL/MIN
0 1 2 3 0 1 2 3
WATER
ACID
TIME IN MINUTES
0 10 20 30 40 50 60 70 80 90

Fig. 1—(Left) Typical pressure record during selective acidizing of well in Carthage field. Note relative pressures on tubing and casing water column while establishing fluid interface. Corresponding acid and water injection rates are shown in Fig. 2. Fig. 2—(Right) Acid and water injection rates during selective acidizing of well in Carthage field. Point at which fluid interface is established and acid breaks into formation is clearly evident. Corresponding pressure variations are shown in Fig. 1

Corrosion-Resisting Plastic Material Applied to Oil-Field Equipment in Place

by E. H. Short, Jr.





Above: Sandblasting tank preparatory to application of vinyl acetate protective coatings. Square of paint remains to be taken off. Right: Mobile equipment used for sand blasting

PERHAPS no other one thing, promised by the war-developed plastics, has been awaited with keener interest by the oil industry than the trial and application of this material as a means of preventing corrosion.

For many years, various liquid concoctions have been painted, sprayed, or smeared on oil-field equipment in an effort to prevent corrosion. Some of these mixtures alleviated corrosion perhaps, but the industry searched on for better materials.

The use of air-drying thermoplastic synthetic resins, a combination of chemically inert organic compounds, is comparatively new. Service companies are now in a position to bake this material on pipe and other equipment at a central plant, thereby enabling the plastic coating to withstand considerable heat; or a type of synthetic resin which is unaffected at 180° F. may be applied directly in the field, either at a central warehouse, or on location.

At the present time it appears that the dip and multiple bake process of plastic application (which must be carried out at a plant designed for this purpose) is essential in coating items which must operate under extremely high temperatures. However, there are many items of oil-field equipment which are not subjected to high temperatures, and to meet the demand for plastic application in the field, The Plastic Coating Corp. of Houston assembled the equipment necessary for field service. At the present time it appears that the following list of oil-field items of equipment may be satisfactorily serviced in the field:

1. Oil-field storage tanks — internal and external.
2. Tubing.
3. Line pipe — oil and salt-water lines.
4. Complete salt-water disposal systems, including salt-water filters.
5. Sucker rods.
6. Valves, fittings, etc.
7. Concrete floors in pump stations, power and compressor houses.
8. Wooden building materials.
9. Oil-field road mats (keeps moisture in wood and should prevent later absorption and subsequent decay).

Obviously, a period of several years (depending upon the type and severity of corrosion) will be required to completely evaluate the protective value of plastics as applied to oil-field equipment. However, early indications, particularly with respect to oil-field storage tanks, are extremely favorable. One of the first plastic applications was made approximately 8 months ago on tanks for two major oil companies in the Magnolia, Arkansas, field. Corrosion is so severe in this area that the operators felt it advisable to examine the tanks at the end of the first 3 months after the plastic application. A thorough inspection of the tanks, both inside and outside, revealed the coating to be in the same perfect condition as it was when applied.

Method of Application

Application in the field is comparatively simple, requiring only a small outlay of equipment. In applying the plastic spray, the first step involves the sandblasting of surfaces to be coated. On internal surfaces of storage tanks, where corrosion is severe, one prime coat and three finish coatings are applied. The protective film thus applied has a thickness of 0.01 to 0.015 in.

If the condition of the metal surface to be coated does not require

sandblasting, it is cleaned by means of wire brush or industrial cleaning compounds. Wooden surfaces which are free from dirt, grease, and oil may be coated without preliminary conditioning. As to concrete surfaces, the best results have been obtained by removing old paint with a solution of hydrochloric acid before applying the plastic.

Generally only one prime coat and two finish coats are required on external surfaces; however, if corrosive conditions are usually severe, four coats are applied. A 30-minute drying period is required for each coat except the last coat. After the last coat has been applied, a period of 48 hours is permitted to elapse before the plastic surfaces are exposed to corrosive liquids. This allows the plastic coating to undergo stages of polymerization by solvent evaporation.

As an idea of the time required for applying this plastic in the field a 4,000-ft. string of sucker rods in West Texas was coated in 1 day. The total time for sandblasting and spraying 500-bbl. tanks averages approximately 8 hours. Two-inch tubing has been sandblasted and sprayed at the rate of 35 joints per day.

The physical properties of the plastic protective coatings are shown below:

Coating thickness — 0.003 in. per spray coat.

Film strength—1,400 psi.

Film stretch at break—180 to 200 per cent.

Moisture vapor resistance—Passes Government Spec. 14130.

Cold resistance — Will not crack when bent at 32° F. Will bend around ⅛-in. rod at 0° F.

Adhesion—Will not blow off in air blasts.

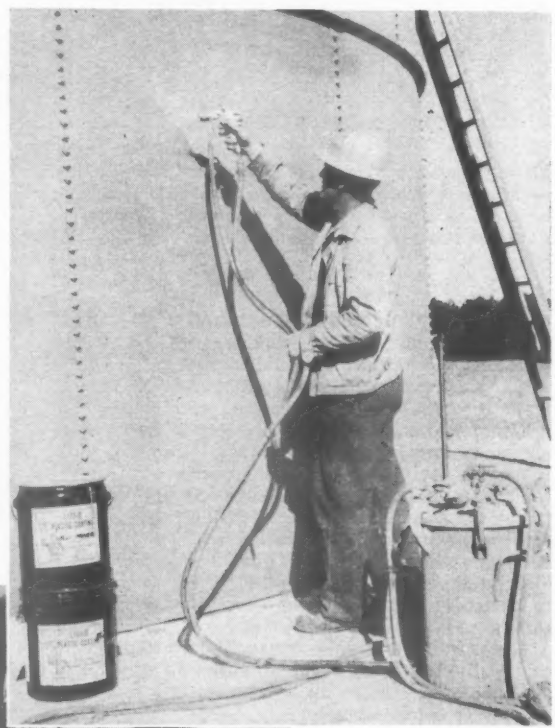
Corrosion resistance—Acids, alkali and salt water.

Heat resistance — Unaffected at 180° F.

The plastic materials being used in the field appear to offer a wide range of protective possibilities. The following table shows the results of laboratory tests made by The Plastic Coating Corp., using a number of reagents.

Reagent—	Four coats (0.006 to 0.008)
A.S.T.M. salt spray	O.K.
Sea water	O.K.
10 per cent nitric acid	O.K.
30 per cent nitric acid	Failure
10 per cent hydrochloric acid	O.K.
25 per cent hydrochloric acid	O.K.
10 per cent sulfuric acid	O.K.
50 per cent sulfuric acid	O.K.
Bleach solution	O.K.
10 per cent sodium hydroxide	O.K.
20 per cent sodium hydroxide	O.K.
Electrolysis (soil test)	O.K.
Tri-color ethylene	Roughened
Carbon tetrachloride	Softens
Ethyl alcohol	O.K.
Hi-test gasoline	O.K.
Aromatic gasoline	Softens
Glacial acetic acid	Failure
Photographic developer Sol.	O.K.
Hypo solution	O.K.
West Texas crude	O.K.
Hastings crude	O.K.

During the past year a large amount of oil-field equipment has been shipped to foreign countries. From time to time reports from some of the tropical areas receiving equipment are to the effect that corrosion has begun before such equipment is placed in use. A plastic strip-type coating developed by The Plastic Coating Corp. appears to have good possibilities for protection of export equipment. This type of protective coating may be applied (before crating operation) by dipping or spraying. It should afford ample protection until the material is placed in use where it can be given operational care. This type of plastic may be stripped off.



Above: Application of vinyl acetate coatings by spray

Left: Scene showing left tank primed with vinyl acetate coatings. Right tank is completely sandblasted preparatory to application of plastic coatings

Production Characteristics for Increasing Rates of Depletion

*by Park J. Jones**

PART 17 OF A SERIES

THE production characteristics for increasing rates of depletion are reviewed in this article. The rates of production and cumulative recovery corresponding to increasing rates of depletion are illustrated graphically and by examples. The rate of production decline increases for increasing rates of depletion. The average annual rate of production decline and the average annual decline of production increase for increasing rates of depletion. The significant characteristic of increasing rates of depletion is the increase of (1) the rate of decline, (2) the average annual rate of decline, and (3) the average annual decline. The value of properties and the advisability of additional investment in reservoirs depends on the prospective rates of production decline. The rate of production decline may increase abruptly for increasing rates of depletion.

THE OPTIMUM RATE OF PRODUCTION

Rate of Production vs. Cumulative Recovery

DENOTE the reserve recoverable at increasing rates of depletion by unity. Let C equal cumulative recovery expressed as a fraction of the reserve. Then (1 — C) is the reserve. The relationship between the rate of production Q and the reserve (1 — C) is defined by

$$Q = R_o (1 - C)^p \qquad (1)$$

where R_o is the initial rate of depletion and the exponent p depends on producing and operating methods. We have seen, in Part 16 of this series, that the value of p for increasing rates of depletion falls between the limits zero and one. We will now illustrate some production characteristics for increasing rates of depletion.

Rate of Production Proportional to ½ Power of Reserve

Let n equal time in years. The general relationship between time and reserve, for rates of production other than those proportional to reserve, is derived in the appendix to this article. Consider a reservoir from which the rate of production is proportional to the ½ power of reserve. For this condition, the cumulative recovery C at any time n is defined by

$$C = 1 - \left(1 - \frac{R_o n}{2}\right)^2 \qquad (2)$$

To obtain the rate of production Q at any time n, we note from Equation 1 that

$$1 - C = (Q/R_o)^2 \qquad (3)$$

Upon eliminating C between Equations 2 and 3, we obtain

$$Q = R_o \left(1 - \frac{R_o n}{2}\right) \qquad (4)$$

The curves in Fig. 17-1 are solutions of Equations 2 and 4. The rate of production, in per cent of the initial rate of production, is plotted against time in years. In this example, the initial rate of production is either 5 or 10 per cent per year of initial reserve. Cumulative recovery is expressed in per cent of initial reserve.

Example 1.—Estimate the producing conditions at the end of five-year intervals for a 400-billion-cubic-foot gas reserve recoverable at rates which are proportional to the ½ power of reserve. Solutions from Fig. 17-1:

	Initial Conditions	
Rate of production, per cent per year	5	10
Billion feet per year	20	40
Million feet per day	54.8	109.6
	Conditions 5 years later	
Cumulative recovery, billion feet	93	174
Producing rate, million feet per day	47.8	82.0
	Conditions 10 years later	
Cumulative recovery, billion feet	175	300
Producing rate, million feet per day	41.0	54.8
	Conditions 15 years later	
Cumulative recovery, billion feet	244	369
Producing rate, million feet per day	34.2	27.4
	Conditions 20 years later	
Cumulative recovery, billion feet	300	400
Producing rate, million feet per day	27.4	0

Example 2.—Estimate the producing conditions at the end of 5-year intervals for a 40-million-barrel oil reserve recoverable at rates which are proportional to the ½ power of reserve. Solutions from Fig. 17-1:

	Initial Conditions	
Rate of production, per cent per year	5	10
Million barrels per year	2	4
Barrels per day	5,480	10,960
	Conditions 5 years later	
Cumulative recovery, million barrels	9.3	17.4
Producing rate, barrels per day	4,780	8,200

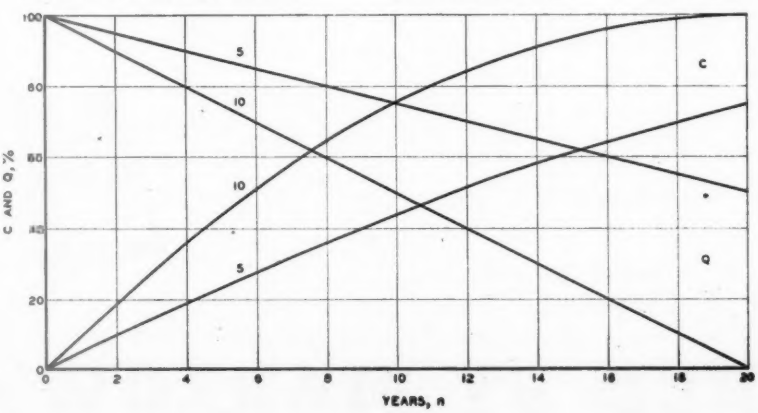
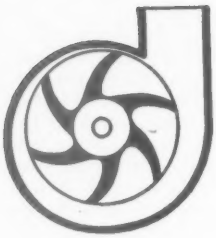


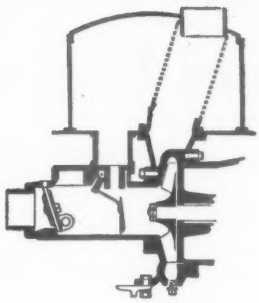
Fig. 17-1—Rate of production Q and cumulative recovery C vs. time in years for 5 and 10 per cent per year initial rates of production; C is in per cent of reserve; Q is in per cent of the initial rate of production; rate of production is proportional to the ½ power of reserve

*Production consultant, Houston.



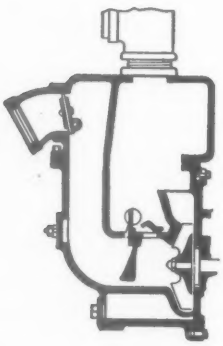
1.

Centrifugal pumps are very efficient . . . quiet, smooth and trouble-free . . . *but they won't prime themselves!* . . .



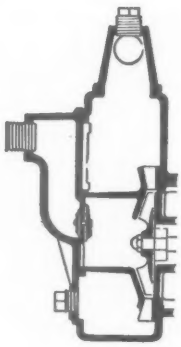
2.

Various auxiliary tanks with connecting ports or valves were developed to help centrifugals prime —an important step forward . . .



3.

Next, tank, valve and pump were assembled into one unit . . . a great improvement. But still, auxiliary devices or by-passes cut efficiency and make trouble . . .



4.

Finally, MARLOW has solved the problem by developing a pump without an auxiliary device or by-pass. The ability to self-prime is inherent in the ingenious design of the pump itself!

Thus, a Marlow self-priming centrifugal pump combines the advantages of centrifugal pumping with the ability to prime itself dependably and to keep going efficiently when other types fail. There is no other pump like a Marlow. Sizes 1½ to 10 inch; 50 to 3600 GPM.

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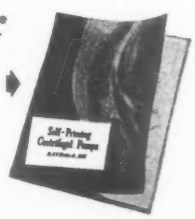

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	Conditions 10 years later	
Cumulative recovery, million barrels	17.5	30.0
Producing rate, barrels per day	4,100	5,480
	Conditions 15 years later	
Cumulative recovery, million barrels	24.4	36.9
Producing rate, barrels per day	3,420	3,690
	Conditions 20 years later	
Cumulative recovery, million barrels	30	40
Producing rate, barrels per day	2,740	0

Rate of Production Proportional to ⅔ Power of Reserve

Consider a reservoir from which the rate of production is proportional to the ⅔ power of the reserve recoverable at declining rates. For this condition, the cumulative recovery C at any time n is defined by

$$C = 1 - (1 - R_o n/3)^3 \qquad (5)$$

To obtain the rate of production Q at any time n, we note from Equation 1 that

$$1 - C = (Q/R_o)^{3/2} \qquad (6)$$

Upon eliminating C between Equations 5 and 6, we obtain

$$Q = R_o (1 - R_o n/3)^3 \qquad (7)$$

The curves in Fig. 17-2 are solutions of Equations 5 and 7. The rate of production, in per cent of the initial rate of production, is plotted against time in years. In this example, the initial rate of production is either 10 or 15 per cent per year of initial reserve. Cumulative recovery is expressed in per cent of initial reserve.

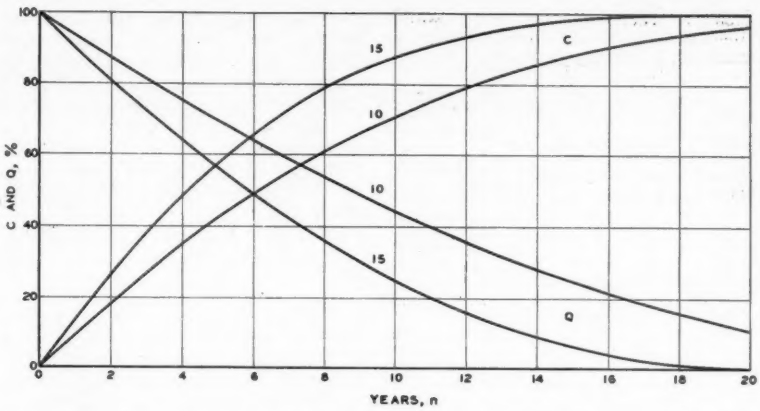
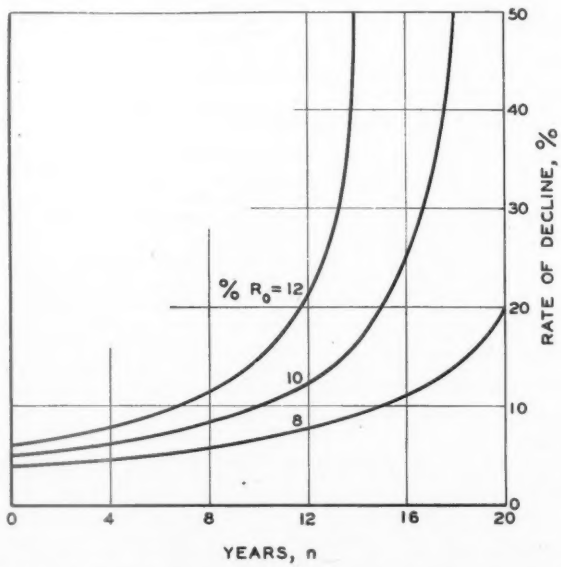


Fig. 17-2—Rate of production Q and cumulative recovery C vs. time in years for 10 and 15 per cent per year initial rates of production; C is in per cent of reserve; Q is in per cent of the initial rate of production; rate of production is proportional to the 2/3 power of reserve

Example 3.—Estimate the producing conditions at the end of 5-year intervals for a 400-billion-cubic-foot gas reserve recoverable at rates which are proportional to the ⅔ power of reserve. Solutions from Fig. 17-2:

	Initial Conditions	
Rate of production, per cent per year	10	15
Billion feet per year	40	60
Million feet per day	109.6	164.4
	Conditions 5 years later	
Cumulative recovery, billion feet	168.8	231.2
Producing rate, million feet per day	75.9	92.5
	Conditions 10 years later	
Cumulative recovery, billion feet	281.3	340.0
Producing rate, million feet per day	48.6	41.1
	Conditions 15 years later	
Cumulative recovery, billion feet	350.0	393.7
Producing rate, million feet per day	27.4	10.3
	Conditions 20 years later	
Cumulative recovery, billion feet	386.5	400
Producing rate, million feet per day	12.0	0

Example 4.—Estimate the producing conditions at the end of 5-year intervals for a 40-million-barrel oil



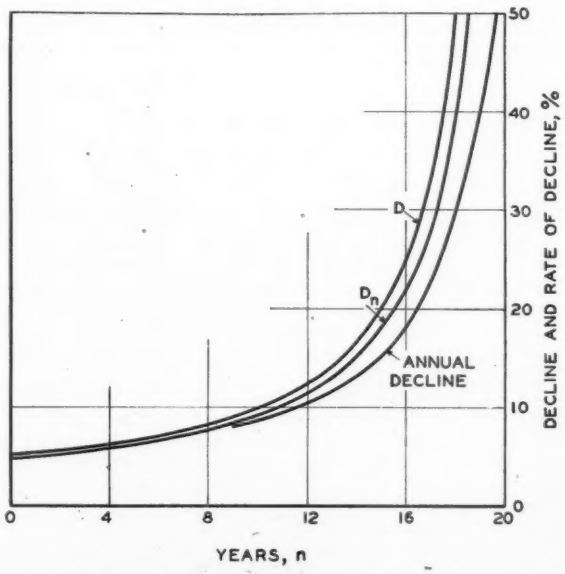


Fig. 17-3—(Left) The rate of production decline in per cent per year vs. time in years and R_o the initial rate of depletion; rate of production proportional to the ½ power of reserve. Fig. 17-4 (Right) The annual rate of decline D, the average annual rate of decline D_n, and the average annual decline of production for a 10 per cent per year initial rate of depletion; the rate of production is proportional to the ½ power of reserve

reserve recoverable at rates which are proportional to the ⅔ power of reserve. Solutions from Fig. 17-2:

	Initial Conditions	
Rate of production, per cent per year	10	15
Million barrels per year	4	6
Barrels per day	10,960	16,440
	Conditions 5 years later	
Cumulative recovery, million barrels	16.9	23.1
Producing rate, barrels per day	7,590	9,250
	Conditions 10 years later	
Cumulative recovery, million barrels	28.1	34.0
Producing rate, barrels per day	4,860	4,110
	Conditions 15 years later	
Cumulative recovery, million barrels	35.0	39.4
Producing rate, barrels per day	2,740	1,030
	Conditions 20 years later	
Cumulative recovery, million barrels	38.6	40.0
Producing rate, barrels per day	1,200	0

Rate of Decline for Producing Rates Proportional to ½ Power of Reserve

The rate of decrease* of production, for rates of production proportional to the ½ power of reserve, is equal to $R_o^2/2$. The relative rate of production decrease is equal to the rate of decrease $R_o^2/2$ divided by the rate of production. The relative rate of decrease is the rate of production decline. Let D equal the rate of decline. Upon dividing $R_o^2/2$ by the rate of production defined by Equation 4, we obtain

$$D = \frac{R_o}{2\left(1 - \frac{R_o n}{2}\right)} \qquad (8)$$

We might note that the initial rate of decline is equal to 50 per cent of the initial rate of production, that is, $D = R_o/2$. The curves in Fig. 17-3 are solutions of Equation 8. The annual rate of production decline is plotted against time for 8, 10, and 12 per cent per year initial rates of depletion. In this example, the rate of production decline is gradual at first. But as abandonment is approached, the rate of production decline increases abruptly. This is characteristic of some natural gas reservoirs, cycling operations and pressure maintenance projects.

Average Annual Rate of Decline

The average annual rate of decline is equal to the difference between the recoveries accumulated during two consecutive years divided by the lesser accumulation. It can be shown, by the methods given in Part 15 of this series, that the average annual rate of decline D_a, for rates of production proportional to the ½ power of reserve, is defined by

$$D_a = \frac{2R_o}{4 + R_o - 2R_o n} \qquad (9)$$

The curve denoted by D_a in Fig. 17-4 is a solution of Equation 9 for a 10 per cent initial rate of depletion. We note that in this example the average annual rate of decline is less than the rate of decline D.

Average Annual Decline

Under some conditions it is advantageous to distinguish between the average annual rate of decline and the average annual decline of production. The latter quantity is equal to the difference between the recoveries accumulated during two consecutive years divided by the greater accumulation. It can be be shown, by the methods given in Part 15 of this series, that the average annual decline of production, for rates of production proportional to the ½ power of reserve, is defined by

$$\text{Average Annual Decline} = \frac{2R_o}{4 + 3R_o - 2R_o n} \qquad (10)$$

The curve denoted by "annual decline" in Fig. 17-4 is a solution of Equation 10 for a 10 per cent initial rate of depletion. We might note that the average annual decline of production is less than the average annual rate of decline. However, the significant characteristic of increasing rates of depletion is the increase of the rates of decline, average rates of decline and decline. Consider valuation of properties based on the lower branch of the curves in Fig. 17-4 as compared to valuations based on the upper branch of the curves. Evidently, the value of properties and the advisability of additional investment in reservoirs depend on the prospective rates of production decline.

Appendix to Article 17

The increase of cumulative recovery dC during a short time interval dn is equal to the rate of production Q, that is

$$\frac{dC}{dn} = Q = R_o (1 - C)^p$$

So the relationship between cumulative recovery and time is defined by

$$n = \frac{1}{R_o} \int \frac{dC}{(1 - C)^p}$$

The solution of this expression, for values of p not equal to one, is as follows:

$$n = \frac{1}{R_o}\left[\frac{1}{(p-1)(1-C)^{p-1}} - \frac{1}{(p-1)}\right]$$

*Obtained by differentiating Equation 4.

Greater Productivity, Ultimate Recovery

(Continued from page 58)

nullifying some of the benefits from previous acidization. The operation requires use of both the annulus and the tubing since a column of water must be pumped and held in the annulus while acid is pumped through the tubing. For this, the packer must be open, which necessitates that the lower zone be treated ahead of the upper zone. After acidizing the lower zone in this manner, the packer is closed and the well brought in, leaving the upper zone to be conventionally acidized through the annulus as a single zone.

It so happens, however, that there is more advantage to be gained by selective acidization in the lower zone than in the upper zone, particularly if the lower zone is the Lower Pettit formation. The latter is made up of five separate members. All are not necessarily present in every well, but where there are two or more separate zones within the same formation there is greater likelihood of the existence of different permeability and porosity characteristics. Under this circumstance it also is easier to control introduction of acid into the respective zones. In the Upper Pettit and Hill zones, particularly the latter, the productive formation usually consists of a single section.

Operation of the Electric Pilot for determining the relative permeability of various zones and for locating the fluid interface to control the top or bottom level of the acid has been described in previous published material.[1] In selective acidization at Carthage, approximately 1,000 gal. of acid are pumped separately into each successive zone of different permeability in the formation being so treated. When this is done, the packer between the lower and upper formation is closed, and both formations then are acidized in the conventional manner. Usually an additional 5,000 gal. will be pumped into the lower formation, previously selectively acidized, for its final acidization.

When an entire formation is acidized as a whole, it is seldom that less than 5,000 gal. are used at a time. In many wells, from 7,000 to

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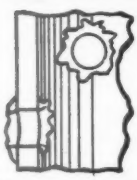

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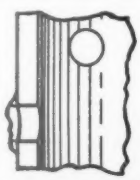

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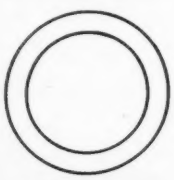

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10,000 gal. may be injected into a single horizon. In some instances the volume has run as high as 14,000 gal.

First application of selective acidization at Carthage was made by Glassell and Glassell in 10 Carthage Unit, completed late last summer. This well also was one of the first in the field in which the use of plastic in squeezing off formations was an important phase of completion. The completion record of this well is given as representative of the technique developed in the field.

This well was drilled to a total depth of 6,500 ft. in the Travis Peak formation where 5½-in., 15.5-lb. casing was set and cemented, using 1,000 sacks of cement for the job. It finally was completed in the Upper Pettit as the bottom zone at 5,635-70 ft., and the Hill as the upper zone at 4,892-4,918 ft. The Hill zone proper was topped at 4,906 ft., but the well has a thin, overlying stringer topped at 4,892 ft. which also was taken in.

Prior to the final completion the well was tested at two different levels in the Travis Peak, first with casing perforations at 6,399-6,411 ft. and second with perforations at 6,319-29 ft., and then in the Lower Pettit with perforations at 6,061-87 ft. In each case 1,000 gal. of acid were injected into the formation for testing. The successive perforations were squeezed following testing, pumping 100 gal. of controlled penetration plastic in each of the two lower levels and 125 gal. in the Lower Pettit. In addition, an intermediate plastic squeeze job was made between the two lower test levels through perforations at 6,352-70 ft. to prevent any channeling between these levels.

Preparatory to completing in the Upper Pettit and Hill zones, additional plastic squeeze jobs were made through perforations at 5,750-54 ft. to prevent the possibility of any channeling between the Lower Pettit and the Upper Pettit, and at 4,932-36 ft. to seal off the Gloyd water sand between the Upper Pettit and Hill zones. In the first instance, 125 gal. were squeezed behind the casing, and in the second, 225 gal.

The casing was perforated with six shots per foot from 5,635 to 5,670 ft. in the Upper Pettit zone and from 4,892 to 4,918 ft. in the Hill zone. Then, 2-in. E.U.E. tubing was run to 5,650 ft. with a slip-type, hook-wall packer at approximately 5,545 ft. to seal the annulus between the two zones, and a sleeve-type circulating valve was installed in the tubing string at about 5,515 ft.

The Upper Pettit, which was selectively acidized, in this case consisted of a lower zone of porosity at 5,650-70 ft., an intermediate relatively tight streak at 5,648-50 ft. and an upper zone of porosity with greater permeability at 5,635-48 ft.

With the packer open and the well circulated to clean the hole of drilling mud, the Electric Pilot was run to locate the interface between the fresh water pumped into the annulus and the acid pumped through the tubing. The section from 5,652 ft. down was acidized first with 1,000 gal. and then, with the casing pump stopped to raise the acid level, an additional 1,000 gal. of acid was pumped and allowed to penetrate the upper section of greater permeability. The packer then was collapsed, and an additional 5,000 gal. was pumped into the entire formation, along with another 5,000 gal. into the annulus above the packer to acidize the Hill zone.

Approximately 37 bbl. of fresh water were used to hold the interface on the first 1,000 gal. of acid pumped into the lower section of the Upper Pettit zone. Maximum pump pressure required on the casing for the water was 1,900 psi., with 1,700 psi. on the tubing to break circulation for the acid. Pressures on the casing and tubing, together with the corresponding injection rates of the water and acid are indicated in Figs. 1 and 2, respectively.

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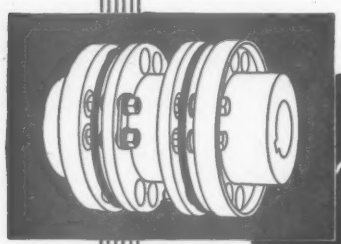

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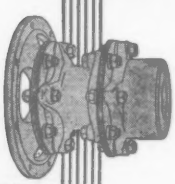

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Reference

1. Hefley, Dana G., and Fitzgerald, P. E., Selective Acidizing and Permeability Determination by an Electrical Method, The Oil and Gas Journal, Feb. 18, 1943, page 37.

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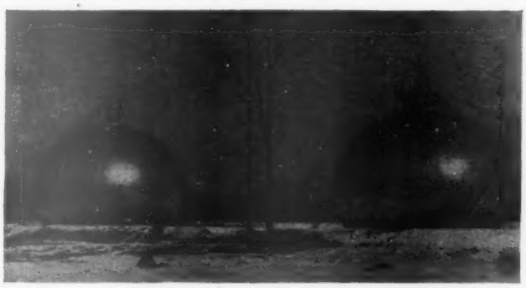

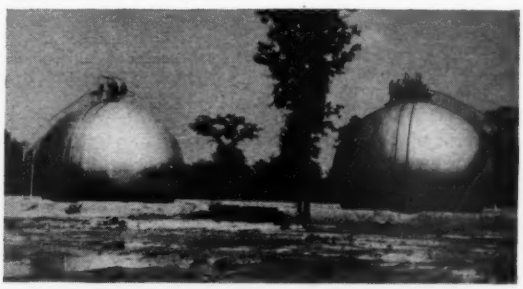

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PRACTICAL PETROLEUM ENGINEERING

Fluid Flow

Graphic Solutions of Design Problems

10—Flow of Gases in Vertical Pipes

by Paul Buthod and B. W. Whiteley

IN the flow of gases through surface lines, the elevation head is usually small and is customarily neglected in computations. However, there are frequent cases such that the elevation head is of considerable importance in determining pressure drop. In gas wells, particularly those at high pressure, neglect of the elevation head would lead to erroneous results, since the wells are frequently 4,000 ft. or more in depth, and the weight of the gas column is appreciable.

Discussion in Article 9 (December 15 issue) brings out the importance of considering the compressibility factor in high pressure gas flow computations. Two practical examples and their solutions were presented in the preceding article. Data for the examples were taken from commercially operating pipe lines and the solutions when compared with operating results show a very high degree of reliability in the method presented in this series.

Flow Up a Vertical Pipe

Neglecting the kinetic energy term which is insignificant, the basic equation for gas flow up a vertical pipe is:

$$vdp = -(1 + \frac{f u^2}{2gd})\, dl \qquad (10\text{-}1)$$

From the equation of continuity:

$$u = 0.0601 \frac{QZT}{D^2 P} \qquad (10\text{-}2)$$

and substituting 10-2 in 10-1, integrating and expressing the result in convenient engineering units gives:

$$P_1^2 + C_1/C_2 = e^{2C_2L}\,(P_2^2 + C_1/C_2) \qquad (10\text{-}3)$$

where:

$$C_1 = 0.00001263 \frac{fsZTQ^2}{D^5}$$

$$C_2 = 0.0188 \frac{s}{ZT}$$

For the higher range of Reynolds numbers where the friction drop becomes of importance, the friction factor may be expressed empirically as:

$$f = 0.0225\, D^{-0.23} \qquad (10\text{-}4)$$

The expression can be used to simplify Equation 10-3 and the resultant equations are:

$$P_B^2 = B(P_T^2 + A) - A \qquad (10\text{-}5)$$

$$P_T^2 = \frac{(P_B^2 + A)}{B} - A \qquad (10\text{-}6)$$

where:

$$A = 0.0000151 \frac{Z^2 T^2 Q^2}{D^{5.23}} \qquad (10\text{-}7)$$

$$B = e^{0.0375\, sL/ZT} \qquad (10\text{-}8)$$

Equations 10-5 and 10-6 are the final equations for the vertical flow of gas up a pipe. The subscript "B" refers to the pressure at the bottom of the flow string whereas the subscript "T" refers to the pressure at the top of the pipe. The compressibility factor is to be evaluated at the average pressure, which makes it necessary to assume an initial value for an average "Z" and check by trial. This procedure, however, is quite simple and adds but little difficulty to the solution. In actual gas wells, a temperature gradient exists between the bottom and top points of the well. Consequently the average temperature between these two points should be used in Equations 10-5 and 10-6.

Vertical Flow Down a Pipe

It is of frequent interest to determine the pressure drop in cases such that the gas flows downward through a vertical pipe. This case includes gas-injection wells in repressuring and pressure-maintenance projects.

The equations for this special case may be derived in a similar manner to Equations 10-5 and 10-6 and indicating only the final results:

$$P_B^2 = B\,(P_T^2 - A) + A \qquad (10\text{-}9)$$

$$P_T^2 = \frac{(P_B^2 - A)}{B} + A \qquad (10\text{-}10)$$

where the notation is the same as that used previously.

Static Bottom-Hole Pressure

If the gas column is in a static condition:

$$Q = 0 \quad \text{and} \quad A = 0$$

Consequently the equations for vertical flow reduce to an expression for a static gas column.

$$P_B^2 = B\, P_T^2 \qquad (10\text{-}11)$$

or

$$P_B^2 = \sqrt{B}\, P_T \qquad (10\text{-}12)$$

The accompanying chart (Fig. 10-1) may be used to obtain the numerical value of "B" for use in any of the foregoing equations. This chart is a graphical solution of Equation 10-8.

Gas Flow Through Inclined Pipes

The foregoing equations apply to vertical pipes. Equations for flow in horizontal pipes have been given previously (Articles 8 and 9). Actually, it adds but little in the way of complications, to derive equations applicable for gas flow through any pipe inclined at an angle "α" with the horizontal. While this general case is not of major interest, it arises in the case of long transmission lines where an appreciable difference in elevation may occur between the initial and final points in the line.

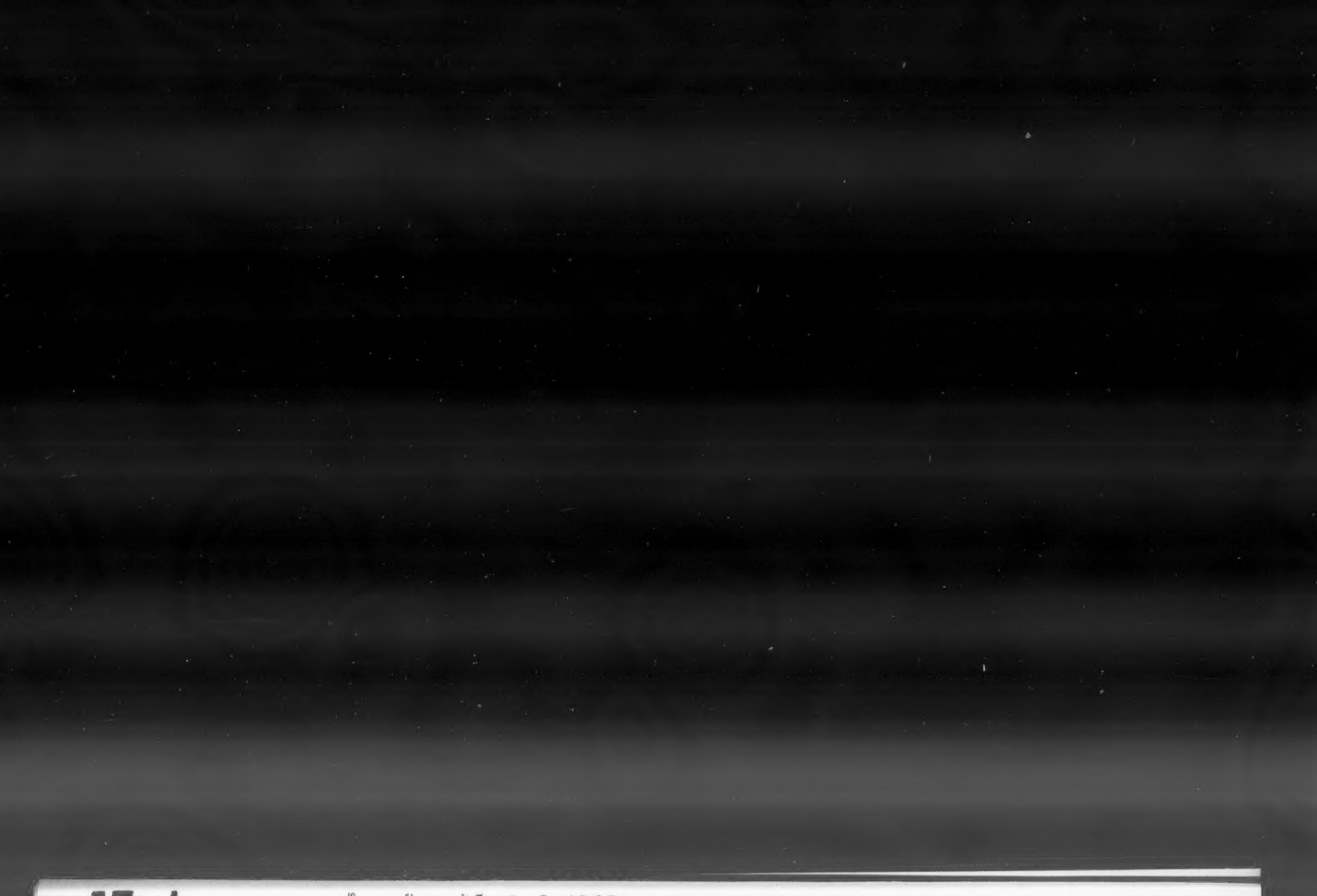
Again neglecting the kinetic energy term as insignificant, the basic equation for gas flow from a lower point to one higher in the line may be written as:

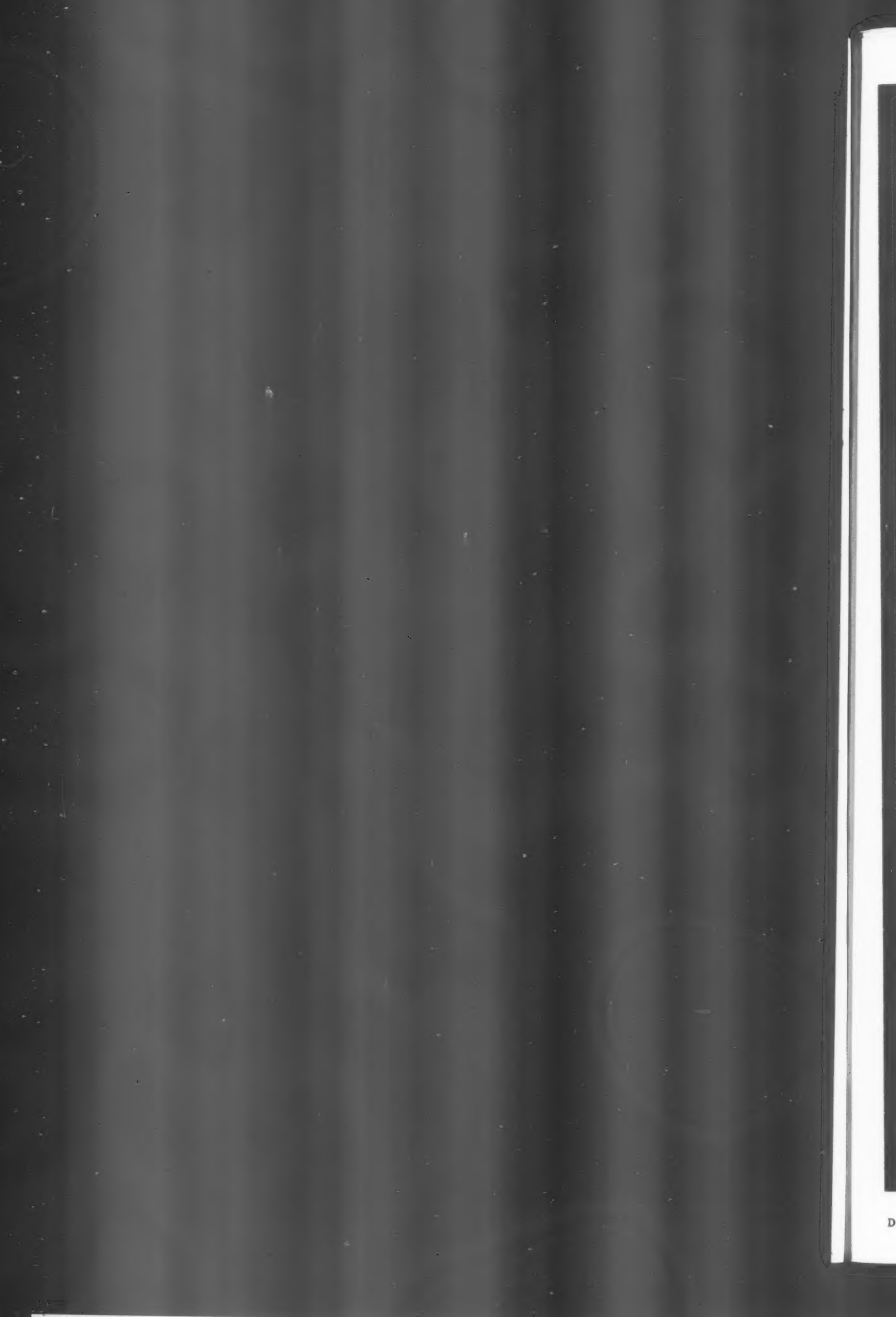
$$vdp = -(\sin\alpha + \frac{f u^2}{2gd})\, dl \qquad (10\text{-}13)$$

Integrating and expressing the result in convenient units:

$$P_B^2 \sin\alpha + C_1/C_2 = e^{2C_2L\sin\alpha}\,(P_T^2 \sin\alpha + C_1/C_2) \qquad (10\text{-}14)$$

Where "α" is the angle with the horizontal plane and "C_1" and "C_2" have the same meaning as previously defined in Equation 10-3. Equation 10-14 is applicable to any real gas flowing upward through an inclined pipe. For the special case





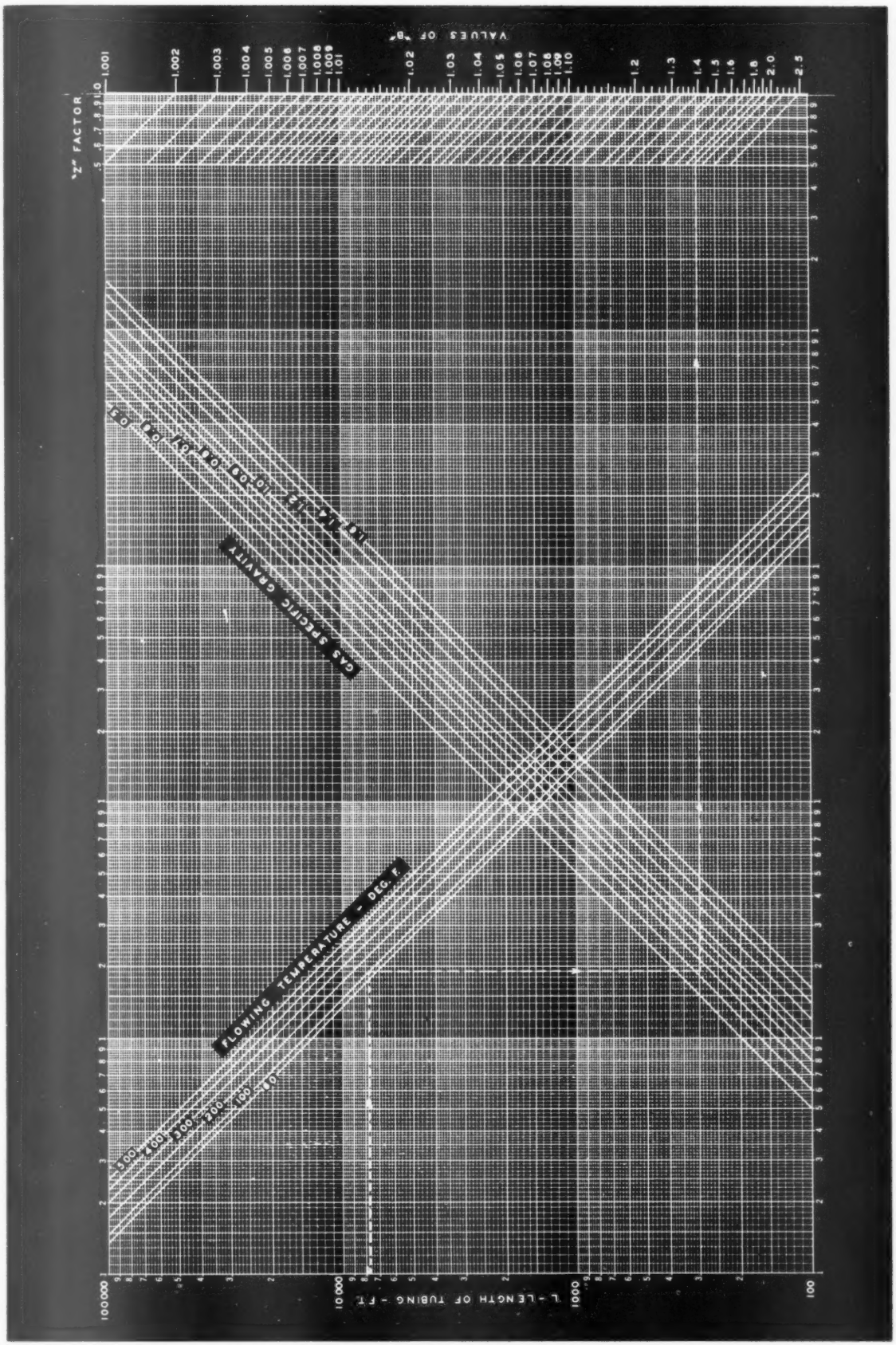

VALUES OF θ'
"Z" FACTOR
GAS SPECIFIC GRAVITY
FLOWING TEMPERATURE - DEG. F
L - LENGTH OF TUBING - FT

Fig. 10-1

of vertical flow ($\sin \alpha = 1$) and Equation 10-14 reduces to 10-3.

For the general case of a gas flowing downward through an inclined pipe, the flow equation is:

$$P_B^2 \sin \alpha - C_1/C_2 = e^{2C_2 L \sin \alpha} (P_T^2 \sin \alpha - C_1/C_2) \quad (10\text{-}15)$$

Where again the symbols are the same as used previously. Flow equations for ideal gases flowing through inclined pipes have been derived previously by Dodge and Thompson.[1] The special case for vertical flow was treated by Kemler[2] who also based the derivation on the ideal gas concept.

The use of Fig. 10-1 in determining the numerical value of "B" is illustrated by the following example:

Example.—Determine the static bottom-hole pressure in a gas well from the following data:

Well depth = L = 7,750 ft.

Shut-in surface pressure = P_T = 3,010 psia.

Gas specific gravity = s = 0.627.

Average temperature = T = 100° F.

Reduced temperature = T_R = 560/335 = 1.67.

Solution.—For the purpose of obtaining an average value for the compressibility factor "Z" it is necessary to estimate the average pressure in the gas column and check this assumption with the final calculated bottom-hole pressure. Using an average pressure of 3,350 psia., then:

Reduced pressure P_R = 3,350/672 = 5.0.

Z = 0.86 (Fig. 6-1).

The value of "B" may now be found from Fig. 10-1. Starting on the left-hand scale at L = 7,750 move horizontally to a temperature line of 100° F., thence vertically downward to a specific gravity of 0.627. From this point move again horizontally to a compressibility factor of 0.86 and following parallel to the diagonal guide lines read a value of B = 1.46.

$$P_B = \sqrt{1.46} \times 3{,}010 = 1.209 \times 3{,}010 = 3{,}640 \text{ psia.}$$

This gives an average pressure of 3,325 psi. which does not change the initial assumed value for an average "Z."

Consequently the static bottom-hole pressure is:

$$P_B = 3{,}640 \text{ psia.}$$

As a short-cut method for use in computing static bottom-hole pressure, the value for $\sqrt{B}$ may be obtained directly from Fig. 10-1 by using a value for "L" on the chart which is one-half the actual tubing length. The value for $\sqrt{B}$ is then read on the right-hand scale. Thus using a value of 7,750/ 2 = 3,875 and otherwise using the same procedure as followed previously gives a value on the right-hand scale of 1.21.

Notation:

- d = pipe diameter, ft.
- **d** = differential operator
- D = pipe diameter, in.
- e = base of natural logs
- f = friction factor, dimensionless
- g = acceleration due to gravity, ft./sec.^{2}
- l = length along pipe, ft.
- L = total length of line, ft.
- p = pressure, lb./sq. in. abs.
- P = pressure, psia.
- P_R = pseudoreduced pressure
- Q = flow rate, M.c.f./day (14.7 psia. and 60° F.)
- s = specific gravity of gas (air = 1.000)
- T = temperature, deg. Rankine
- T_R = pseudoreduced temperature
- u = linear velocity, ft./sec.
- v = specific volume, cu. ft./sec.
- Z = compressibility factor, dimensionless
- α = angle of inclination with horizontal, deg.

Subscripts:

- 1 = initial point in flow string
- 2 = final point in flow string
- B = lower point in flow string
- T = upper point in flow string

References

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2. Kemler, E., "A Study of the Data on the Flow of Fluids in Pipes," Trans. A.S.M.E. 55 (1933).

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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Octane Improvement by Mercaptan Removal

In several of your questions you have discussed octane improvement by catalytic desulfurization. Why do you leave out the chemical processes for desulfurization? How do they affect the leaded octane number?—A.A.B.

In our question of November 17, 1945, page 284, it was shown that catalytic desulfurization (with attendant reforming, etc.) improved the leaded octane number (3 cc. tetraethyl lead) by an average of 3 to 12 octane-number units depending on the original clear octane number. One improvement was as high as 13 but four samples gave improvements lower than 2 units, in a total of about 50 samples.

There was no intention on the part of this department to neglect the chemical desulfurization processes such as caustic washing, Solutizer, Unisol, caustic methanol wash, Tannin Solutizer, etc., but the leaded-octane-number improvement by these processes is small compared with the improvement caused by catalytic desufurization. The tabulation on this page indicates improvements in leaded octane number (3 cc. tetraethyl lead) of only 0.3 to 4.4 units of octane number, with 35 of the 58 tests showing improvements lower than 2 octane units.

From the standpoint of general improvement and cost, these processes may ordinarily be superior to the catalytic desulfurization processes but for the purpose of attaining high leaded octane number the catalytic processes are superior.

The accompanying tabulation was not grouped according to clear octane number but there is some indication that stocks of low octane number are upgraded more than are high-octane stocks. Of course, the original content of mercaptan sulfur compounds is a greater factor than the clear octane number of the stock, in altering the lead susceptibility.

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7. Lowry & Moriarty—The Oil and Gas Journal, November 3, 1945, pg. 105—Unisol Process Improves Octane Number and Lead Susceptibilty.

LEADED OCTANE NUMBER (MOTOR METHOD) IMPROVEMENT BY CHEMICAL DESULFURIZATION

Stock—	Clear octane number		Octane number with 3 cc. TEL			
	Raw	Desulfurized	Raw	Desulfurized	Improvement	Ref.
Mercapsol:						
Talco, Texas	69.2	69.6	75.2	77.7	1.5	(1)
Mid-Continent	63.9	68.4	85.2	87.7	2.5	(1)
Solutizer:						
Cracked	70.6	71.6	78.6	79.4	0.8	(2)
Straightrun	72.0	...	84.0	87.0	3.0	(2)
West Texas, straightrun	52.0	52.0	69.5	70.0	0.5	(2)
Aviation, straightrun	68.2	68.6	82.7	86.2	3.5	(2)
Straightrun	65.0	...	...	...	3.9	(3)
Straightrun	45.5	...	...	...	1.2	(3)
Straightrun	60.5	...	...	...	1.3	(3)
Straightrun	53.0	...	...	...	0.3	(3)
Straightrun	63.5	...	...	...	3.3	(3)
Straightrun	62.0	...	...	...	2.4	(3)
Straightrun	43.5	...	...	...	4.3	(3)
Straightrun	70.5	...	...	...	1.5	(3)
Cracked	63.0	...	...	...	2.8	(3)
Cracked	63.0	...	...	...	1.4	(3)
Cracked	75.5	...	...	...	2.4	(3)
Cracked	70.5	...	...	...	2.3	(3)
Cracked	62.5	...	...	...	0.6	(3)
Cracked	70.0	...	...	...	1.7	(3)
Cracked	72.0	...	(2 cc.—1.2)	...	...	(3)
Cracked	64.5	...	...	...	0.4	(3)
Cracked	65.0	...	...	...	1.3	(3)
Cracked	66.0	...	...	...	1.5	(3)
Cracked	70.0	...	...	...	2.5	(3)
Cracked	59.5	...	...	...	1.5	(3)
Cracked	69.5	...	...	...	0.7	(3)
Cracked	67.5	...	...	...	2.7	(3)
Cracked	70.0	...	...	...	1.1	(3)
Cracked	70.0	...	...	...	0.9	(3)
Cracked	68.0	...	...	...	1.0	(3)
Blends, str. and cr.	67.0	...	...	...	0.5	(3)
Blends, str. and cr.	67.0	...	...	...	2.0	(3)
Blends, str. and cr.	58.0	...	...	...	0.7	(3)
Cata. poly.	70.0	...	...	...	2.0	(3)
Cata. poly.	82.5	...	...	...	0.7	(3)
Ave. str.	57.9	...	...	...	2.28	(3)
Ave. cr.	67.4	...	...	...	1.55	(3)
Ave. all	65.3	...	...	...	1.68	(3)
Caustic methanol (unisol):						
L. A. Basin, cracked, 240 e.p.	79.0	79.0	81.0	83.5	2.5	(7)
L. A. Basin, cracked, 390 e.p.	68.5	69.5	78.0	79.5	1.5	(7)
Santa Maria cracked	71.5	72.5	82.5	85.0	2.5	(7)
Cal. cracked and reformed	73.2	74.5	76.9	79.9	3.0	(7)
Montana cracked	69.8	70.6	77.5	79.5	2.0	(7)
Poly. and high-sulfur cr.	74.0	74.0	81.5	83.5	2.0	(4)
High-sulfur cr.	68.6	68.8	76.0	76.9	0.9	(4)
Illinois str.	51.6	51.8	68.5	70.9	2.4	(5)
Low-sulfur cr.	70.0	70.2	79.3	81.1	1.0	(4)
W. Tex. str.	69.2	70.6	(79.4)	(80.9)	(1.5)	(4)
W. Tex. str.	68.5	72.0	(78.0)	(81.3)	(3.3)	(4)
Mixed straightrun	62.5	64.2	78.2	80.5	2.3	(4)
High v.p. blending stk.	62.0	62.0	(73.6)	(78.0)	(4.4)	(4)
Illinois str.	51.6	51.8	68.5	70.9	2.4	(5)
Illinois cr.	67.1	67.1	76.5	77.8	1.3	(5)
E. Tex. cr. and str.	*70.4	*70.8	*85.3	*86.5	1.5	(5)
Michigan cr.	66.5	66.5	75.8	78.3	2.5	(5)
W. Tex. str.	70.9	71.9	(79.9)	(81.4)	(1.5)	(5)
Panhandle Texas	63.2	63.2	72.2	73.4	1.2	(5)
W. Tex. cr.	66.0	66.5	71.4	74.2	2.8	(5)
Low-sulfur cr.	71.5	71.5	80.0	81.6	1.6	(5)
Low-sulfur cr.	69.2	69.4	78.5	79.8	1.3	(5)
S. Texas cr.	70.0	70.0	77.9	79.1	1.2	(5)
Tannin solutizer	63.8	63.8	74.0	75.6	1.6	(6)

*C.F.R.-Research octane number. ( ) Parenthesis indicates only 2 c.c TEL.

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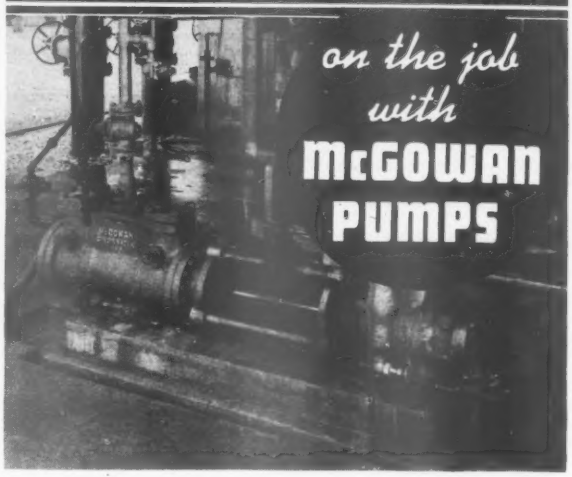

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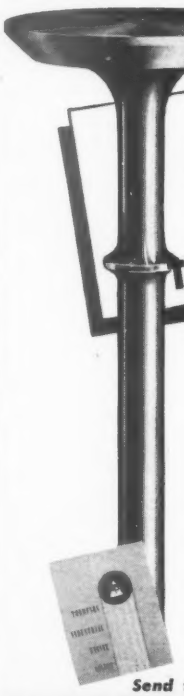

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Simplified Catalytic Cracking Unit Meets Requirements of Smaller Refiners

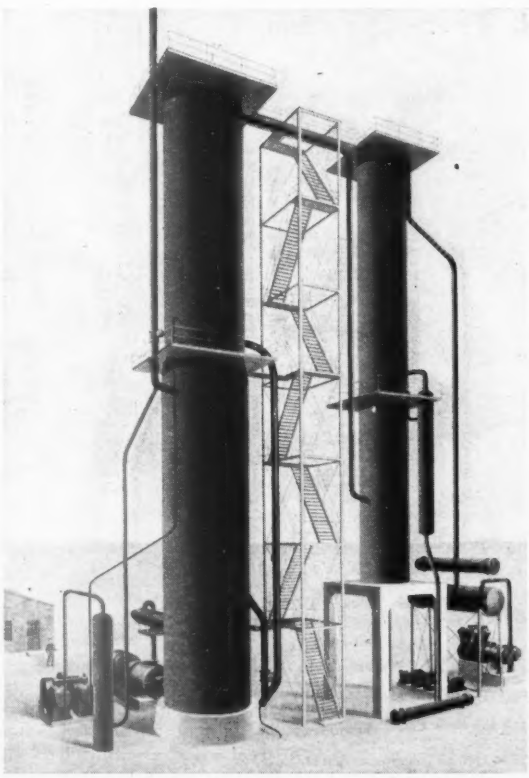
*by N. K. Anderson and M. J. Sterba**

A smaller-capacity catalytic cracking unit has been designed for the use of the smaller-capacity refinery, the details based on experience in building and operating wartime Fluid units. This plant operates at temperatures ranging from 800° to 1,000° F., on stocks ranging from naphthas to topped crudes, fed to the catalyst section without preflashing. Mechanical design is simplified greatly by placing the regenerator immediately above the reactor, in the same column. Microspherical form of catalyst is used in the new adaptation of the Fluid process. Yields of 45 to 53 per cent gasoline are obtained, showing octane ratings of 79 to 82 (A.S.T.M.), and 89 to 93 (CFR-Research). Operating costs vary from 23.8 cents per barrel of charge for a 4,500-bbl. unit with natural catalyst to 44.0 cents per barrel of charge for a 900-bbl.-per-day unit with silica-magnesia or silica-alumina synthetic catalyst.

AS a result of the experience gained through design and operation of numerous fluid catalytic cracking units built during the war for the production of aviation gasoline, UOP has been able to develop an efficient and simplified catalytic cracking unit to meet the smaller refiners' needs.

The many improvements and simplifications embodied in the MS-type design have resulted in a marked reduction in investment cost, as well as substantial decreases in operating, maintenance, and utility requirements, so that this unit can now be installed and operated at a cost comparable with that of a thermal cracking unit of the same capacity. There has been no sacrifice in performance to realize these economies; in fact, there has been an actual improvement in processing efficiency. At the same time, the unit has retained all of the inherent advantages of the original fluid-type operation which make it extremely flexible in regard to conditions at which it can be operated, or charging stock which can be processed. All of the improvements incorporated in this new MS-type design have been fully demonstrated in pilot plants, semicommercial scale, or commercially operating units.

*Universal Oil Products Co.



The U.O.P. MS-type catalytic cracking unit

As an illustration of the flexibility of the fluid process, commercial fluid cracking units have been operated with reactor temperatures ranging from as low as 800° F. to as high as 1,000° F. Stocks processed commercially have ranged from gasolines to topped crude fed directly to the catalytic section without preflashing. Various recycling operations and combinations of catalytic and thermal cracking operations have been thoroughly investigated.

The inherent flexibility of the fluid catalytic cracking unit plus the economies of the MS-type design combine to make this unit entirely practical for the smaller refiner who is faced with the prob-

N. K. ANDERSON

M. J. STERBA

Dr. Nils K. Anderson was graduated from Armour Institute of Technology in 1938, with a B.S. degree in chemical engineering. In 1941 the degree of Ph.D. in chemical engineering was conferred upon him by University of Wisconsin. In the same year Dr. Anderson joined the staff of Universal Oil Products Co. where he has been engaged in research and development in various phases of catalytic cracking, dehydrogenation and other processes. He is a member of American Institute of Chemical Engineers and of American Chemical Society.

M. J. Sterba was graduated from University of Wisconsin in 1932 with a B.S. degree in chemical engineering. From 1932 to 1935 he was employed by C. F. Burgess Laboratories, Inc., Madison, in the development of a process for production of titanium dioxide from titanium-bearing ores. He joined Universal Oil Products Co. in 1935. In the engineering research department he was engaged in correlation of laboratory, pilot-plant and commercial data on thermal cracking, reforming, hydroforming, and catalytic cracking. More recently, in the service department, he has been supervising initial operations of catalytic cracking units and performance testing of various processing equipment in refineries. Mr. Sterba is a member of American Institute of Chemical Engineers.

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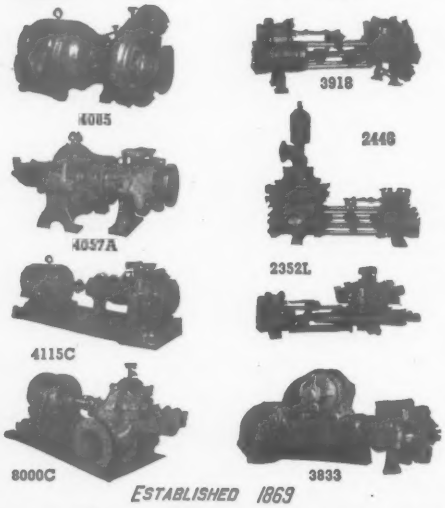

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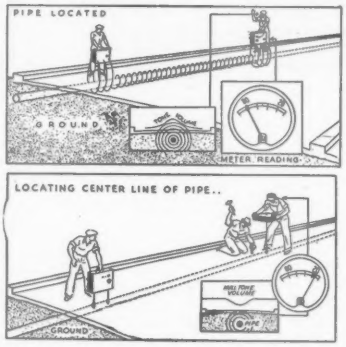

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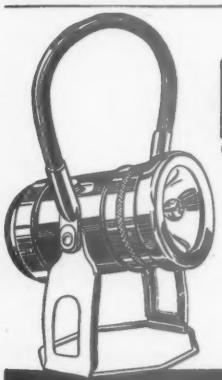

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Briefly, the flow shown by Fig. 1 for the new MS-type unit is as follows:

The oil feed is charged as a liquid at the base of the reactor riser; hot catalyst from the regenerator enters this riser at the point of oil injection, supplies the process-heat requirements, and is transported upward by the vaporized oil into the reactor.

Spent catalyst is continually withdrawn from the upper part of the reactor dense phase to hold the level in the reactor and is passed downward through the stripping section into the regenerator. Inert gas prepared by water scrubbing a small portion of the flue gas is used for stripping.

Catalyst flows downward through the regenerator countercurrent to the air supplied at the bottom for combustion. Additional stripping of the spent caltalyst is obtained in the upper section of the regenerator where the bulk of the flue gas from the combustion of coke in the lower sections contacts the incoming catalyst.

Regenerated catalyst flows from the lower section of the regenerator into the reactor riser at a rate controlled to maintain a constant reactor temperature. The regenerator flue gas is vented to the atmosphere through an internally mounted cyclone separator which recovers entrained catalyst and returns it to the regenerator dense phase.

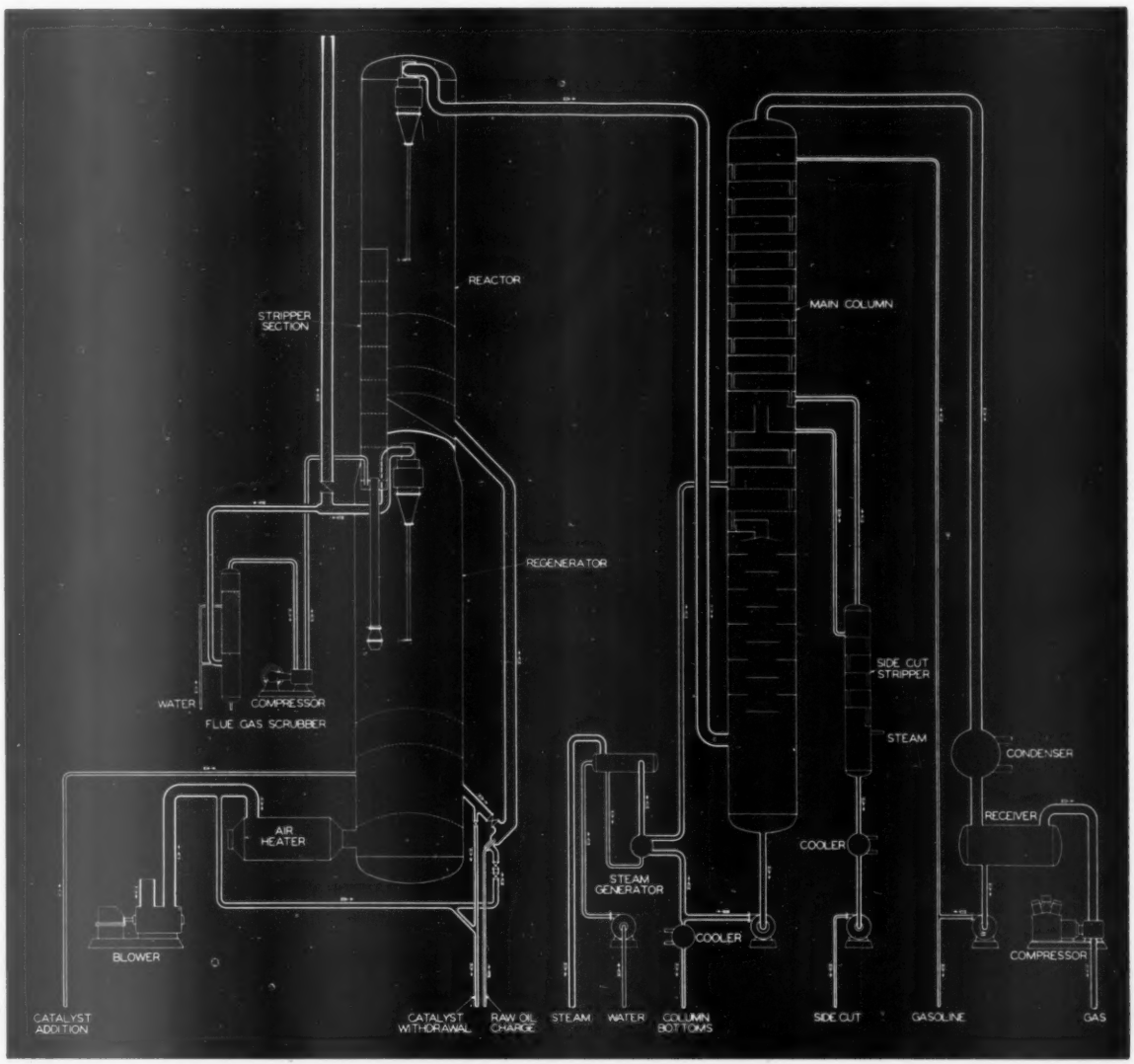
The reaction products pass into the fractionator vapor line through an internally mounted cyclone separator which recovers entrained catalyst and returns it to the reactor dense phase. The vapors enter a conventional fractionating column bottoms, a side-cut stream, gasoline, and gas are prepared in the customary manner. Heat is recovered by circulating column bottoms through a steam generator and returning the oil stream to the fractionator at an intermediate point. Adequate facilities for stabilizing the gasoline and preparing polymerization feed have been provided.

Discussion

The experience gained by Universal through the operation of numerous fluid catalytic cracking plants has been applied to the design of the new MS-type unit. This new development permits substantial reductions in installation costs as well as lower operating costs with improved performance. The major modifications in the MS-type unit as compared with the fluid unit of earlier design which have made these benefits possible are:

1. The regenerator and reactor

Simplified flow chart of U.O.P.'s MS-type catalytic cracking unit



have been combined into a single vessel which is erected as a self-supported column and is completely shop fabricated for moderate size units. In all sizes the heavy structure required in the earlier units has been eliminated.

2. The large regenerator riser has been eliminated, the regenerator standpipe is greatly shortened; and there has been a general elimination and simplification of small piping.

3. All equipment for secondary catalyst recovery, such as a Cottrell precipitator or an oil scrubber on the regenerating side, and a slurry settler or slurry recirculating system on the processing side, has been eliminated.

4. The efficiency of both the reactor and regenerator has been improved by the use of additional distribution grids in each section.

5. The air supplied for combustion passes through the regenerator countercurrent to the flow of catalyst.

The obvious simplification of the unit as indicated by the changes listed in the first three points results in a marked reduction in total investment, in maintenance charges, and in operating costs. This saving in itself is a major item. Then, paralleling this simplification process, there has been a redesign of the remaining elements of the plant to make them function with the greatest possible efficiency. Here the experience gained through operation of fluid catalyst plants has dictated the following changes:

1. Unlined pipe is used throughout the unit.

2. The countercurrent regenerator results in only air passing through the main distribution grid. The distribution is simple and positive.

3. The system of catalyst flow control has been modified to reduce erosion on the control valves. Experience in the field indicates that these changes have eliminated this difficulty.

4. The design of the cyclone separators used in the new unit is such that maintenance is a minor item.

5. A monolithic regenerator lining of refractory cement has replaced the former brick lining.

All of the simplifications and mechanical changes noted above result

TABLE 1 — TYPICAL YIELDS AND PRODUCT QUALITIES — U.O.P. MS-TYPE CATALYTIC CRACKING PROCESSING MID-CONTINENT GAS OIL ONCE-THROUGH OPERATION AT 65 PER CENT CONVERSION

Catalyst—	Silica-magnesia	Natural	Silica-alumina
Yields, volume per cent:			
Debutanized, 400° F. end-point gasoline	53.0	48.9	45.5
Cycle stock, 400° F.+	35.0	35.0	35.0
Butylenes	5.5	5.8	6.2
Butanes	5.5	7.4	10.9
Propylenes	3.8	4.8	6.8
Propane	1.9	3.4	3.7
C_2 and lighter gas, weight per cent	1.9	1.7	1.7
Debutanized, 400° F. end-point gasoline (5-6 lb. R.v.p.):			
Octane No. A.S.T.M. (F-2):			
Clear	79.1	80.3	82.1
+3 cc. TEL	85.2	86.5	87.7
Octane No. research (F-1):			
Clear	89.0	90.8	93.0
+3 cc. TEL	95.4	96.5	98.7
Cycle stock, 400° F.+:			
Gravity, °A.P.I.	26	26	26
C_2 and lighter gas:			
Molecular weight	12	12	14
Heating value, B.t.u./cu. ft.	740	740	840

TABLE 2—PRODUCTION SUMMARY FOR ONCE-THROUGH CATALYTIC CRACKING OF MID-CONTINENT GAS OIL

Catalyst form:	Microspherical Silica-Magnesia			Powdered Natural			Microspherical Silica-Magnesia		
Type catalyst:									
Charge, b.c.d.	900	2,700	4,500	900	2,700	4,500	900	2,700	4,500
Conversion, 100-vol. % cycle	65	65	65	65	65	65	65	65	65
C_3 and lighter, M.c.f.c.d.	164	494	822	147	441	735	126	379	631
C_2 and lighter, 10^3 B.t.u./c.d.	121	363	605	108	375	541	106	319	531
Propylene, b.c.d.	36	108	180	43	129	215	61	183	305
Propane, b.c.d.	17	51	85	31	92	153	34	101	168
Butylenes, b.c.d.	50	150	250	52	156	260	56	168	280
Isobutane, b.c.d.	39	117	195	54	161	268	82	246	410
n-Butane, b.c.d.	10	30	50	13	40	67	16	48	80
Debutanized, 400° F. e.p. gasoline, b.c.d.	477	1,430	2,385	440	1,320	2,200	409	1,230	2,045
Cycle oil, b.c.d.	315	945	1,575	315	945	1,575	315	945	1,575
Over-all yields without polymerization:									
10-lb. R.v.p., 400° F. e.p. cat. crkd. gasoline, b.c.d.	503	1,510	2,515	463	1,390	2,315	431	1,291	2,155
10-lb. R.v.p., 400° F. e.p. cat. crkd. gasoline, vol. %	55.9	55.9	55.9	51.5	51.5	51.5	47.9	47.9	47.9
Cat. crkd. gasoline F-2 O.N. clear	79.8	79.8	79.8	80.9	80.9	80.9	82.4	82.4	82.4
Cat. crkd. gasoline F-2 O.N. 3 cc. TEL	86.7	86.7	86.7	87.9	87.9	87.9	88.6	88.6	88.6
Excess butanes, b.c.d.	63	189	315	84	252	420	117	350	583
Cycle oil, b.c.d.	315	945	1,575	315	945	1,575	315	945	1,575
Fuel gas, M.c.f.c.d.	264	790	1,317	282	845	1,410	300	901	1,501
Fuel gas, 10^6 B.t.u./c.d.	368	1,103	1,840	443	1,330	2,216	536	1,610	2,682
Over-all yields with polymerization:									
10-lb. R.v.p., 400° F. e.p. cat. crkd. gasoline, b.c.d.	503	1,510	2,515	463	1,390	2,315	431	1,291	2,155
10-lb. R.v.p., 400° F. e.p. cat. crkd. gasoline, vol. %	55.9	55.9	55.9	51.5	51.5	51.5	47.9	47.9	47.9
10-lb. R.v.p. motor polymer, b.c.d.	54	162	270	60	179	299	72	217	362
10-lb. R.v.p. motor polymer, vol. %	6.0	6.0	6.0	6.6	6.6	6.6	8.0	8.0	8.0
Total 10-lb. R.v.p. gasoline, b.c.d.	557	1,672	2,785	523	1,569	2,614	503	1,508	2,517
Total 10-lb. R.v.p. gasoline, vol. %	61.9	61.9	61.9	58.1	58.1	58.1	55.9	55.9	55.9
Excess butanes, b.c.d.	19	57	95	38	113	188	66	197	329
Cycle oil, b.c.d.	315	945	1,575	315	945	1,575	315	945	1,575
Fuel gas, M.c.f.c.d.	224	672	1,120	247	742	1,237	232	694	1,158
Fuel gas, 10^6 B.t.u./c.d.	276	828	1,380	363	1,089	1,814	377	1,130	1,884
Cat. crkd. gasoline F-1 (research) O.N. clear	89.7	89.7	89.7	91.2	91.2	91.2	93.5	93.5	93.5
Cat. crkd. gasoline F-1 O.N. +3 cc. TEL	96.3	96.3	96.3	97.2	97.2	97.2	99.5	99.5	99.5

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in investment, maintenance, and operating economies which are of fundamental importance in adapting the fluid catalyst plant to the smaller refiners' needs.

Improvements in Efficiency

It has long been felt that more effective use could be made of the catalyst in the reactor both in regard to conversion and product distribution. It has been found that the installation of additional grids achieves both purposes: first, it permits running at higher space velocities for a given conversion; second, it improves the product distribution by giving more gasoline and less gas and coke at a given conversion. Both effects are quite appreciable. The grids function to prevent circulation of catalyst and reaction products (principally gasoline) from the top of the reactor dense phase toward the bottom. The circulated reaction products acted to decrease the effective oil partial pressure and rence, decreased conversion; at the same time, recirculated gasoline was cracked further to gas and coke, resulting in a loss of yield. The installation of additional grids has markedly improved the processing efficiency of the reactor.

The stripper has been completely redesigned and several installations indicate considerable improvement resulting from the changes. It has been so arranged in the reactor that flow of spent catalyst from the reactor dense phase into the stripper can occur only at the top of the reactor dense phase while the level is allowed to vary. This gives a true top drawoff of spent catalyst from the reactor and obviates bypassing of regenerated catalyst and unconverted raw oil into the stripper. This same feature enhances the effect of the additional grids in the reactor.

To improve the primary function of the stripper, i.e., to remove oil vapor from the spent catalyst going to the regenerator, the geometric proportions have been changed to give a stripper with a high length to diameter ratio; in addition, the stripper has been staged by adding grids. Both mechanical changes result in a marked improvement in stripping of spent catalyst by reducing "end-over-end" mixing.

With the countercurrent flow of catalyst and air through the staged regenerator it has become possible to improve its efficiency. The countercurrent flow makes feasible complete oxygen utilization with the additional feature of another period of hydrocarbon distillation and stripping of the spent catalyst in the upper section of the regenerator where the bulk of the flue gas from the combustion of coke in the lower sections comes in contact with the incoming catalyst. These points, together with the redesign of the reactor which improves the product distribution, permit a substantial reduction in regeneration requirements, both in vessel size and in air quantity.

The more favorable carbon-oxygen relationship in this staged regenerator results in an increased carbon-burning rate despite the considerably lower average temperature of the dense phase. In addition, the regenerator is designed to run under pressure which further increases the carbon burning rate.

Catalyst Activity

This increase in burning rate, at a given temperature, effected by staging the regenerator with countercurrent operation at a higher pressure, permits an appreciable reduction in the volume of catalyst required in the combustion zone. This point is directly related to the question of catalyst consumption in the cracking process. Hence, at this time the general case of catalyst deactivation and mechanical losses will be considered.

Catalyst deactivation is primarily a function of high temperature plus steam, when no substantial contamination of the catalyst is occurring. The steam can be either that adsorbed and occluded by the catalyst in the present strippers or that

TABLE 3—SUMMARY OF OPERATING COSTS FOR U.O.P. MS-TYPE CATALYTIC-CRACKING UNITS

	Microspherical silica-magnesia			Powdered natural			Microspherical silica-alumina		
Charge throughput, b.c.d.—	900	2,700	4,500	900	2,700	4,500	900	2,700	4,500
Operating costs per calendar day:									
1. Operating supervision at $350 per month	$11.70	$11.70	$11.70	$11.70	$11.70	$11.70	$11.70	$11.70	$11.70
2. Operating labor at $1.20 per hour (average)	86.40	115.20	115.20	86.40	115.20	115.20	86.40	115.20	115.20
3. Maintenance labor and materials	66.00	132.00	182.00	73.00	146.00	269.00	66.00	132.00	182.00
4. Utilities*	48.70	114.10	164.90	51.70	123.10	176.50	48.70	114.10	164.90
5. Laboratory (additional) labor and chemicals	48.80	48.80	48.80	48.80	48.80	48.80	48.80	48.80	48.80
6. Catalyst	67.50	202.50	337.50	27.00	81.00	135.00	67.50	202.50	337.50
7. Royalty	45.00	135.00	225.00	45.00	135.00	225.00	45.00	135.00	225.00
8. Taxes and insurance	22.00	44.00	61.00	25.00	49.00	90.00	22.00	44.00	61.00
	$396.10	$803.30	$1,146.10	$368.60	$709.80	$1,071.20	$396.10	$803.30	$1,146.10
Cost per barrel charge (cents)	44.0	29.8	25.5	41.0	26.3	23.8	44.0	29.8	25.5

*Net steam at 25c/M lb.; circ. water at 2c/M gal.; fuel at 15c/MM B.t.u.; electricity at 1c/kwh.

TABLE 4—SUMMARY OF OPERATING COSTS FOR U.O.P. LIQUID FEED CATALYTIC POLYMERIZATION UNITS
(To Complement Catalytic Cracking Operating Costs in Table 3)

	1	2	3	4	5	6	7	8	9
10-lb. R.v.p. polymer produced, b.c.d.	50	162	270	60	179	299	72	217	362
Operating costs per calendar day:									
1. Operating labor at $1.20 per hour (average)	$28.80	$28.80	$28.80	$28.80	$28.80	$28.80	$28.80	$28.80	$28.80
2. Maintenance labor and materials	8.00	10.30	15.00	8.00	10.30	15.00	8.00	10.30	15.00
3. Utilities*	15.60	40.20	65.40	17.00	44.00	72.10	19.80	52.70	86.70
4. Laboratory (additional)	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
5. Catalyst	6.70	20.20	33.60	7.40	22.30	37.20	9.00	27.00	45.10
6. Royalty	10.10	30.20	50.40	11.10	33.40	55.80	13.45	40.50	67.60
7. Chemicals	3.80	11.40	18.90	4.20	12.55	21.00	5.00	15.20	25.40
8. Taxes and insurance	6.20	8.00	11.70	6.20	8.00	11.70	6.20	8.00	11.70
	$87.20	$157.10	$231.80	$90.70	$167.35	$249.60	$98.25	$190.50	$288.30
Cost per gallon 10-lb. R.v.p. polymer produced (cents)	3.85	2.31	2.04	3.60	2.22	1.99	3.25	2.09	1.90

*Net steam at 25c/M lb.; circ. water at 2c/M gal.; fuel at 15c/MM B.t.u.; electricity at 1c/kwh.

formed in the regenerator by the combustion of hydrogen-bearing catalyst deposits; the high temperature zone is in all cases the regenerator.

The source of steam in the first instance can be eliminated by going to inert gas stripping. This has been done, with a simultaneous redesign of the stripper to permit low stripping gas rates in order to avoid overloading the gas concentration equipment.

In the case of steam from combustion the effect can only be minimized. This was accomplished first by improving the stripping of the spent catalyst which reduces preferentially the amount of hydrogen-rich material entering the regenerator. Second, it was done by taking advantage of the countercurrent flow of catalyst and air to stage the regenerator. There are three stages; at the top, there is a low temperature section with little or no combustion, acting as an additional stripping and hydrocarbon distillation zone; next, a zone of moderate temperature wherein the remaining hydrogen-rich material is burned with the least ill effect; and finally a small high-temperature zone where the combustion of low hydrogen coke takes place.

The above-given features of the MS-type unit substantially decrease the rate of catalyst deactivation. Their effect is augmented by the lower average regenerator temperature and the decrease in volume of catalyst held in that vessel resulting from the higher carbon burning rate realized by the installation of grids and the higher operating pressure.

After evaluation of the above-indicated reductions in the rate of loss of catalyst activity, the emphasis on the question of catalyst consumption becomes one of reducing mechanical losses. In view of this, the development of the MS-type catalyst assumes particular importance. This type of catalyst is made in the form of microspheres, extremely resistant to attrition, small enough to be fluidized easily, and large enough to make recovery by a cyclone separator very simple. Furthermore, the abrasion of metal parts is considerably less by the MS-type catalyst when compared to ground powder. Performance tests have verified the desirable properties of the microspherical form and all evidence points to a well-balanced catalyst which will minimize the rate of replacement.

Catalysts

The simplest design of the MS-type unit is based on the use of the microspherical synthetic catalyst (MS catalyst). However, a catalyst in the powdered form, either synthetic or natural, can be used with certain additions to the basic plant design. Two synthetic MS-type catalysts, silica-alumina and silica-magnesia, are available. Silica-alumina catalyst would be used if maximum octane rating is the primary consideration. The gasoline yield with silica-magnesia catalyst is substantially higher but the octane rating is lower. Because of the lower cost per pound of the natural catlyst its use should also be considered. This catalyst gives a gasoline yield and octane rating intermediate to the values obtained with the synthetic catalysts but with a higher coke production and catalyst replacement rate. Economic considerations of market requirements and operating costs will govern the choice of catalyst.

Yields and Costs

The accompanying tables give a comprehensive picture of the yields, productions, and operating costs of the MS-type catalytic cracking unit.

Yields and product qualities obtained in a once-through operation on a typical Mid-Continent gas oil with each of the three catalysts at

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a constant conversion of 65 per cent and a constant reactor temperature are summarized in Table 1.

In order to illustrate the application of the MS-type catalytic cracking unit, there is shown a summary of the production and operating costs for three sizes of operations with each of the three catalysts. This study is based on MS-type units having gas-oil charge capacities of 1,000, 3,000, and 5,000 bbl. per stream day with an on-stream efficiency of 90 per cent.

The production summary with and without subsequent polymerization of the C_3-C_4 olefins appears in Table 2. The operating costs for the catalytic cracking units are given in Table 3. A summary of operating costs for the complementing U.O.P. polymerization units is presented in Table 4.

Operating costs for the catalyst cracking units are based on receiving a gas oil charge stock and cover the entire operation of the unit through absorption, debutanization of the catalytically cracked gasoline, and preparation of a liquid polymerization feed. The various items of cost together with the corresponding rates used in the estimate are listed separately in Tables 3 and 4. The catalytically cracked gasoline can be finished in almost all cases with no treatment other than a caustic wash and the addition of inhibitor.

Summary

The greatest single advantage of the fluid type catalytic cracking unit is its flexibility. Commercial fluid units have been operated with reactor temperatures ranging from as low as 800° F. to as high as 1,000° F. Stocks processed commercially have ranged from gasolines to topped crude fed directly to the catalyst section without preflashing. Various recycling operations and combinations of catalytic and thermal cracking operations have been thoroughly investigated.

The many improvements and simplifications found in the MS-type design have reduced investment and operating costs until they compare favorably with the costs of a thermal cracking unit of the same capacity. This has been accomplished while retaining all of the inherent advantages of the original fluid type operation and improving its processing efficiency.

The economics and improved performance of the MS-type design with all of the flexibility of the fluid cracking process make this unit entirely feasible for the smaller refiner who is faced with the need of raising the octane rating of his motor gasoline.

Merry Christmas

REPUBLIC NATIONAL BANK

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BOOKS

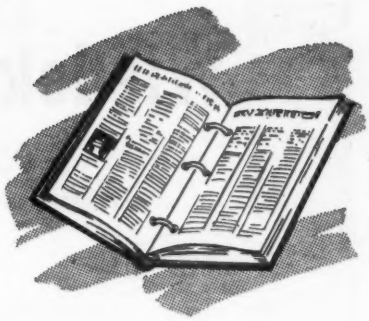
A. S. T. M. STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS. Published by A.S.T.M. Committee D-2. Methods of Testing, Specifications, Definitions, Charts and Tables. 1945. 546 pp. $2.75.

Two new proposed methods of test, one for maximum pour points of lubricating oils containing pour-point depressants, and the other for determining total olefinic and aromatic hydrocarbons in gasoline, have been published for information and comment only. and show the trend of the times in the problems faced by the industry in testing the various petroleum products of more recent development. This new volume shows the most recently revised methods promulgated by the committee as employed by the oil and automotive industries with the customary information regarding committee personnel and organization, specifications for standard products, etc.

Changes within the committee include discharge of Subcommittee 4 on Grease, with F. E. Rosensthiel as acting chairman, and its duties assigned to a new Technical Committee G on Lubricating Greases. Technical Committee B on Lubricants was reorganized into Technical Committee B on Lubricating Oils, T. C. Smith, chairman, J. C. Geniesse, secretary, which includes an executive committee and 12 sections. Technical Committee G on Lubricating Greases has F. L. Wright, chairman, C. W. Georgi, vice-chairman, and H. A. McConville, secretary. This committee includes an executive committee and three sections.

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL



Temperature Difference In Exchangers

THE high temperature of one fluid as compared with the other is the driving force by which heat is caused to flow into the colder fluid. Obviously, the larger the surface bathed in the two fluids the larger the amount of heat transferred. Finally, fluids (vapor or liquid) differ in their ability to deliver heat or to absorb heat. Thus, gases and very thick liquids have poor heat-transfer rates, regular liquids or greatly compressed gases transfer heat well, and condensing vapors or liquids at very high velocities are the best transferers of heat. These general facts are usually described as follows:

$$Q = HA\Delta T$$

in which:

Q = heat transferred, B.t.u. per hour

A = area of surface, sq. ft.

H = transfer rate, B.t.u. per hour transferred through each square foot for each 1° F. average difference in temperature between the two fluids

ΔT = temperature difference, average °F. from end to end in the whole exchanger

No discussion about A (area) is necessary except to state that in general the area should be computed on the basis of the diameter which handles the gaseous or the more viscous fluid. Thus, if cracked residuum is flowing inside of tubes with crude oil on the outside of the tubes, the inside area of the tubes should be used in computing the area. The transfer rate H will be discussed in The Refiner's Notebook No. 83 and hence can be dismissed from consideration here except to state that the rates are somewhat as follows for petroleum refinery conditions:

Water cooling—	Transfer rate
Vapor cooling	5-15
Vapor condensing	18-80
Oils cooled	15-70
Exchanging with oil—	
Vapor condensing	20-60
Oils cooled	9-50

Temperature Difference

The temperature differences from end to end in an exchanger is indicated in Fig. 1. Temperature is shown vertically and distance (or surface) is shown horizontally. Other flow conditions than counter-current can be arranged but they are never as suitable as the directions of flow shown in the figure. It will be noted that the smaller-volume fluid (unless it is condensing) changes more in temperature than the large-volume fluid. The temperature differences at the two inlet ends of the exchanger are designated as Δ for the larger difference and δ for the smaller difference. The average temperature difference at all points in the exchanger is almost universally expressed as the **logarithmic mean temperature** difference. A chart will be published in The Refiner's Notebook No. 75 (January 5, 1946) by which the log. mean difference can be computed.

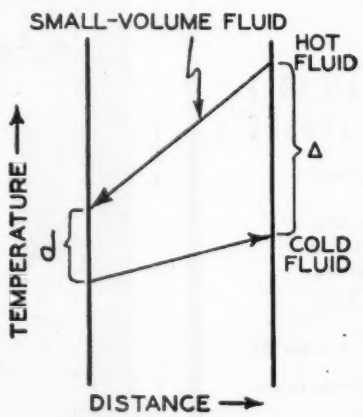


Fig. 1—Sketch of temperature conditions in a counter-current flow exchanger or cooler in which the hot-fluid is smaller in volume

For practical purposes, and in fact all purposes other than experimental research, the arithmetic average temperature difference may be used except that it should be reduced by 3 to 13 per cent if the volume of one of the fluids is twice as much as the volume of the other (or more times larger). Thus, for practical refinery design or operation studies, the two following rules may be used:

Rule 1—If the ratio of the temperature difference at the two ends of the exchanger is 2½ to 1 or less, use the average of the two temperature differences.

Rule 2—If the ratio of the two differences is 2½ to 1 or more, use 90 per cent of the average temperature difference.

These rules introduce an error of less than 4.5 per cent (plus or minus) and this amount of error is far less than the error introduced by our lack of knowledge concerning transfer rates, dirt (salt, coke, corrosion scale, etc.) on the tubes of the exchanger, and the failure in most commercial exchangers to attain true counter-current flow. Thus, the practical heat transfer formula may be written as:

$$Q = (.9 \text{ to } 1)\, HA\Delta T$$

in which ΔT is the arithmetic mean temperature difference.

Example.—An exchanger heats crude oil from 100° to 180° F. by gas oil which is cooled from 500° to 280° F. The larger temperature difference (Δ) is 500 — 180 or 320, the smaller (δ) is 280 — 100 or 180. The ratio of the two differences (320 ÷ 180) is 1.78, and the average ΔT is approximately:

$$\frac{320 + 180}{2} = 250° \text{ F.}$$

This is an error of only 6° or 2.5 per cent from the much more complicated logarithmic mean temperature difference.

No. 73 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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Fig. 40 Ideal Ace Tube Expanders, used for most types of Stationary, Locomotive and other Fire Return Tubular Steam Boilers. In 52 years of rolling they have achieved a most enviable record for service, economy and durability.

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FIG. 40

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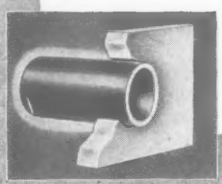
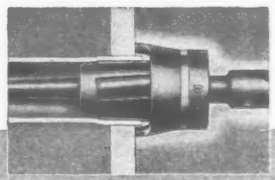
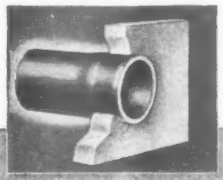


Tube set in sheet with proper projection for bead.



Tube rolled steam tight in sheet.



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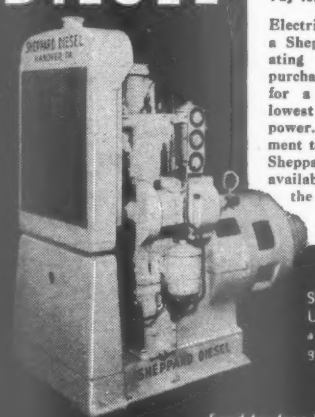

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Concrete—Miscellaneous Details

ORDINARY concrete has a "thirst" for water. This comes about in that concrete has varying amounts of porosity and permeability, which depend upon the proportions and mixing of the materials and other factors. Thus some water absorption and penetration is to be expected, although it is a fact that the passages to water gradually become clogged by fine silt present in the water. The richer the mix, the higher is the degree of impermeability secured.

"Membrane method" of waterproofing is the application of a continuous and elastic bituminous sheet or membrane to prevent entry of water into those portions of the structure below ground. Materials used are hot applications of commercial asphalt or mastics, as binders, together with asphalt felt or burlap. The distribution should be completely about the outside surfaces that may be exposed to water, and sometimes it is good practice to provide underground drains to eliminate large accumulations of water near the structure.

"Integral method" of waterproofing involves cement mixes whereby the concrete structure itself becomes waterproof. Various commercial preparations are available for this purpose. Stearate (fatty acid) components form calcium stearate when added to cement. This material is insoluble and acts as a lining on the side walls of the pores or voids, and consequently renders the surfaces nonwettable to water. One compound consists of a finely divided metallic powder which oxidizes upon the addition of water. The subsequent expansion of these particles occurs in the structure when the material is brushed onto the surface and seals off the surface against the passage of water. Another waterproofing development, for the waterproofing of concrete, stucco and masonry walls, is composed of "irreversible" inorganic gels. These gels attach themselves by chemical action to the surfaces and allow the outward escape of water vapors, but lock out or impede any absorption of water inward. These materials are available in various colors, and thus serve as a decorative finish as well as for waterproofing. Distinction is to be made that certain of these commercial preparations are available to use as a part of the cement at the time it is mixed, while others are used as surface coatings for structures previously built.

Color and hardening additives.—Cement work, particularly walks, steps, and other such items where a decorative finish is desired, can be permanently colored by adding pigments directly into the concrete at the time of mixing. Such concrete work often proves much easier to maintain in pleasing appearance than by the application of oil-base paints which gradually wear off under traffic and must be frequently re-covered. Commercial materials also are available for placing into the finishing or topping coat of floors and other surfaces that are exposed to hard wear and scraping action.

Freezing.—At about 35° F. the setting reaction between water and cement practically ceases. Concrete kept at that temperature will not have much strength, although it is not necessarily damaged. Whenever the temperature is increased, the reaction will progress at greater rates and larger gains in the strength of the concrete are obtained. However, when freshly mixed or recently set concrete is frozen, it is rarely satisfactory. The freezing of the water in the recently hardened mass causes disruptive forces when the hardened cement paste itself is too weak to give resistance, and tensile failures are present in the bond with the aggregate as well as within the interstitial paste. Frozen concrete can be recognized by its white color in contrast to retaining its dark slate color for several days in somewhat higher temperatures. Frozen concrete can be tested by heating it or immersing it in hot water; it becomes soft if frozen. Badly frozen concrete may swell and spall here and there.

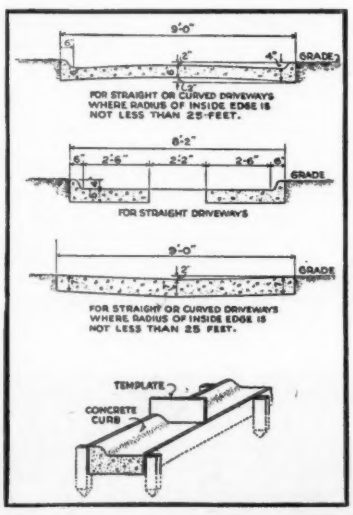


Fig. 1

Reinforced concrete.—One of the greatest improvements in concrete construction is the use of reinforcing rods and meshes. Concrete itself is very weak in tension and has very little elasticity, two properties which steel possesses to a high degree. Hence, steel reinforcing rods are imbedded in concrete members subject to tension and the two materials complement each other in doing their own share of the total work. The combination thus acts as a unit, with the best property of concrete, that for resisting compression, joining with the good property of steel, high tensile strength, and both serving together.

Floors and walks.—Slab structures will shrink when the concrete takes its set and provision should be made for joints to take care of the contraction at evenly divided locations. Space between joints can be provided by tar paper or other material to keep the concrete units from joining together. A monolithic slab is one constructed so that the base (major) portion is joined together with the finish or topping coat. The base concrete is poured and an hour or two afterwards the finished coat is spread on to a thickness of ½ to 1 in. On the other hand, it also is possible to pour the base concrete, screed it to a fairly level surface, allow it to harden, and then use it as a working surface for an indefinite time before applying the topping or surfacing coat. In this case, when the topping is applied, the base concrete should be thoroughly cleaned, either chipped off or well brushed with a weak solution of hydrochloric acid, thoroughly washed with water, then brushed with a neat cement grout before the topping layer is applied.

Driveways and curbs.—Suggested designs for concrete construction in this class is given in Fig. 1.*

References

*"1,001 Ways to Use Concrete," by H. O. Hayes.

"Standard Construction Methods," by G. Underwood, McGraw-Hill Book Co.

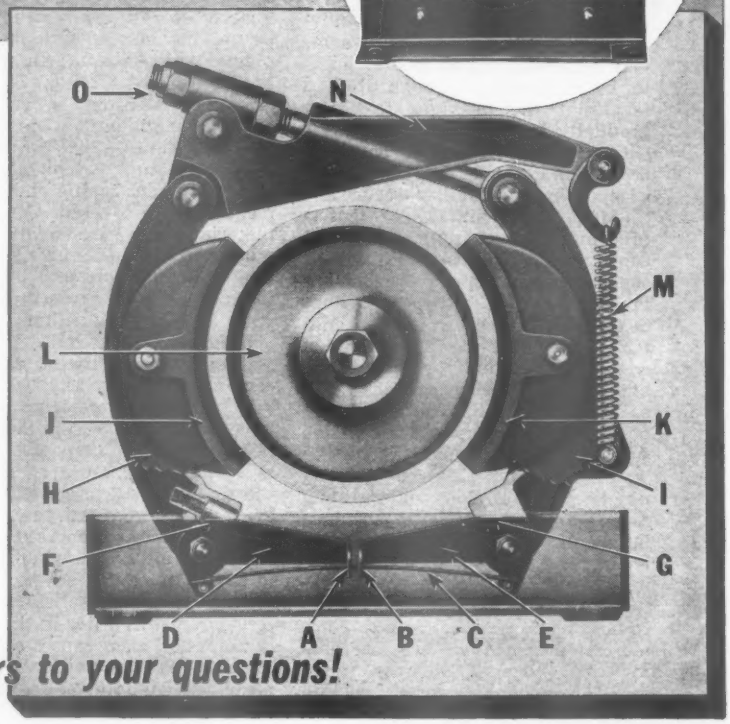
"Design of Concrete Structures," by L. C. Urquhart and C. E. O'Rourke, McGraw-Hill Book Co.

"Theory and Practice of Reinforced Concrete," by C. W. Dunham, McGraw-Hill Book Co.

New Device Self-Centers Brake Shoes on Wagner Hydraulic Bridge Brakes

Prevents Shoe Drag . . .
(thus saving brake lining)

The new self-centering device on Wagner hydraulic bridge brakes will mean savings of money and time to the user. This new device prevents dragging of brake shoes (thus saving brake lining)



—and here are the answers to your questions!

QUESTION: *How does the Self-Centering Device work?*

ANSWER: It works on the same principle as the swinging door—a spring returning the door to the same starting point, irrespective of direction of swing. When brake is released, spring M pulls down brake lever arm N, causing shoe arms H and I to be spread apart to clear brake wheel L. Spring C assures equal movement of both shoe arms, thus preventing either shoe from remaining in contact with brake wheel L.

Spring C presses equally against contact points A and B (which are equally distant from center of spring), moving equalizing arms D and E upward until they are in line with each other. Equalizing arms D and E press against shoe arms H and I at contact points F and G—and as the pressure is at all times equal, the shoe arms are moved out (away from the brake wheel) equal distances, carrying both shoes J and K equal distances away from the brake wheel L. Neither shoe can drag.

QUESTION: *Does Lining wear affect the self-centering device?*

ANSWER: No. When brakes are applied, shoe arms H and I move toward the brake drum L. Contact points F and G move downward, pressing equalizing arms D and E downward against spring C at contact points A and B. As the brake lining wears, contact points F and G move relatively farther, pressing equalizing arms D and E farther down. Spring C will be depressed to a greater degree—but when the brake pressure is released, spring C will bear equally against points A and B, and as explained above both shoe arms will be moved away from the brake drum equal distances, and the shoes are again centered as before irrespective of change in lining thickness.

QUESTION: *Are adjustments necessary to keep self-centering device operative?*

ANSWER: No, except when installed. This is done at contact point F by means of a set screw which is locked after shoes have been accurately centered. Wear factor at contact points is so insignificant that no appreciable change in centering of shoes will occur.

QUESTION: *How are shoes adjusted to compensate for lining wear?*

ANSWER: At point O where a "one-point adjustment" repositions shoes to compensate for lining wear.

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For further information — without obligation—I have checked numbered circles above ✓ **Which correspond to new equipment items or trade literature abstracts appearing in the Oil and Gas Equipment Digest of The Oil and Gas Journal, dated**

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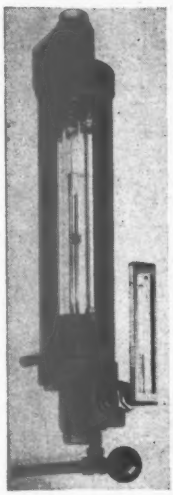
OIL AND GAS EQUIPMENT Digest

IT'S NEW CHECK IT

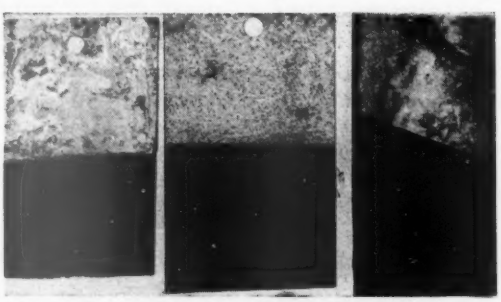
by Kenneth B. Barnes



(1) SPECIFIC-GRAVITY INDICATOR gives continuous indication of a flowing sample, rather than utilizing the time-lagging, often troublesome, intermittent sampling procedure. Liquid rises in the heavy-walled glass tube to the outlet pipe, overflows, and is returned to the process. Specific gravity is indicated on a standard hydrometer within the tube. There also is an integrally mounted thermometer. *Schutte & Koerting Co.*

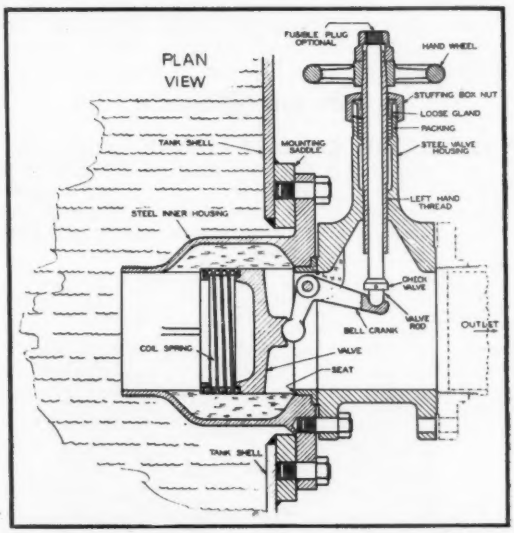
IT'S NEW CHECK IT

(2) ALKACITE CORROSION-RESISTANT COATING, when applied to any porous surface —metals, wood, concrete, etc.—penetrate the surface, effectively blocking off moisture penetration, acid reaction. Retards corrosion, rotting, and disintegration. Alkacite is a high-solid, sprayable, high-coverage prime or finish coat for protection of steel. Alkacite brushing mastic is applicable to tank linings for water, acid and alkali solutions. Will not craze, crack, alligator, check, loosen, or scale. Resists vibration and bending. *Protective Coatings, Inc.*



In 2% H_2SO_4 *In 4% salt solution* *In 5% HCl*

(3) INTERNAL VALVE safeguards contents of storage tanks against "run-off" in event of line breakage. The fusible plug melts at critical temperature, releasing the valve rod and cutting off



the flow automatically in case of fire. Since the working parts are mostly within the tank, they are protected from cold weather. *Oceco Div., The Johnston & Jennings Co.*

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(4) BART LECTRO-CLAD PROCESS develops a smooth, ductile, pore-free nickel deposit fully adherent to the base metal. Applied to pipe or tubing up to 18-in. diameter. Makes steel pipe corrosion-resistant. Fittings and accessories are available for complete piping systems. The internally plated pipe can be welded, reduced and bent, hot or cold, without destroying any portion of the internal lining. Costs only a fraction as much as solid pipe of corrosion-resistant alloys. *Bart Manufacturing Co.*

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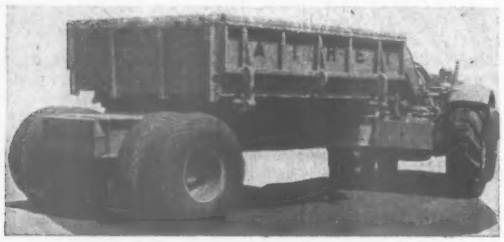

(5) PD-10 TRAILER is new rubber-tired unit for high-speed hauling on construction and earth-moving projects. Has maximum capacity of 15 tons. Hydraulically-controlled, discharges load from either side at 55° angle. *Athey Products Corp.*

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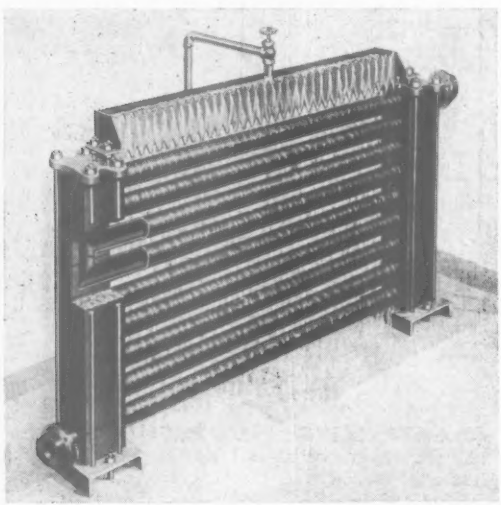
(6) KARBATE CASCADE COOLER efficiently cools corrosive liquids and gases. A complete cooler assembly is quickly erected from four standard items, in any of five pipe sizes. Additional units may be put on just as one would stack office filing



cases. The well-known properties of Karbate impervious graphite include corrosion resistance, high heat-transfer rate, resistance to thermal shock, freedom from corrosion-scale formation. Water distributor is mounted on tie-rod assemblies and can be accurately adjusted to assure uniform cooling water distribution. *National Carbon Co.*

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(7) NEW NI-ROD ELECTRODE has been produced to make machinable welds in cast iron, marking a distinct step forward in welding. Another new electrode is the "133" 80-20 nickel chromium electrode for welding the Inconel side of Inconel clad steel. *The International Nickel Co., Inc.*

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(8) AERONCA CHAMPION has high utility for the private owner. It will get into and out of small places in oil-country use, and land in ordinarily inaccessible areas. Equipment on the new postwar design includes dual brakes, steerable tail wheel, compass, cabin heater, and airmaze carburetor intake. Other new features are a preformed one-piece plexiglass fireproof windshield, greater "elbow" room in cabin, additional baggage space, and an all-metal automobile-type door with map compartment. Weight empty is 710 lb.; rate of climb 500 ft. per minute; landing speed 38 m.p.h. *Aeronca Aircraft Corp.*

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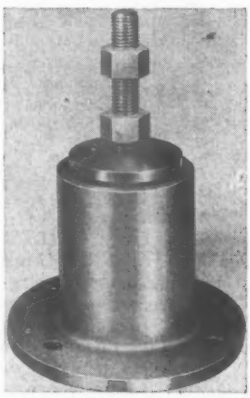
(9) VIBRO-LEVELERS nullify destructive shakes. They are low-cost rubber-insulated machinery mountings. Dual purpose, they stop vibration and are a means of leveling the machinery. Nine sizes, load capacities from 10 to 2,000 lb. each. Require no greasing or other maintenance attention. Leveling is by two nuts, one for adjusting machine, the other for locking in position. *Bushings, Inc.*



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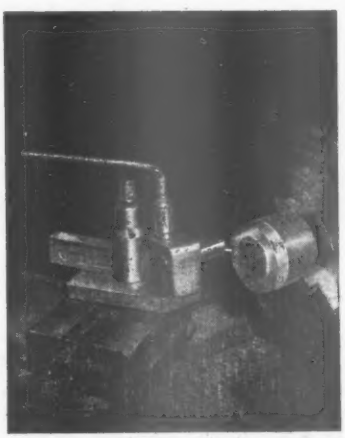
(10) UNIVERSAL TOOLHOLDER speeds engine lathe operations when a series of identical cuts is to be made. Fits lathe tool post in conventional



manner. The detachable heads hold high-speed or carbide-tipped tool bits. Requires less than 3

seconds to change from one tool to another. *Lane-Wells Co.*

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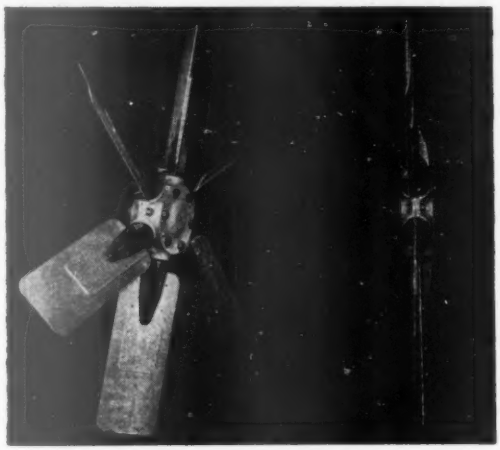
(11) NEW THERMO-CONTROL FAN responds instantly when the engine says "Give me more air!" Results in more uniform temperature dis-



tribution throughout the engine compartment. Automatic variable-pitch control of blade is through Vernatherm power element. *Evans Products Co.*

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(12) ALL-PLASTIC MONOGOGGLE provides unobstructed vision and high degree of comfort. Weighs only 1¼ oz. The nonshatterable crystal-clear plastic lens can be worn comfortably over any prescription glasses. *Willson Products, Inc.*

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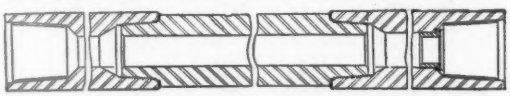
(13) NONMAGNETIC DRILL COLLAR permits taking of directional single shot records inside drill pipe. Used immediately above the regular



bit. Tests report directional records can be obtained at great savings of rig time. Particularly advantageous in directional drilling. *Sperry-Sun Well Surveying Co.*

IT'S NEW CHECK IT

TRADE LITERATURE

(14) CENTRIFUGAL PUMPS AND IMPELLERS. A short textbook on this subject to assist those charged with the selection and operation of centrifugal pumping equipment in avoiding some of the commoner causes of pump failure. Twenty pages packed with meaty facts and basic knowledge of pumping equipment. *The Deming Co.*

IT'S NEW CHECK IT

(15) SPEED REDUCERS. Worm and herringbone geared speed reducers are featured in this catalog published by one of the foremost manufacturers in this field. Design calculations and rating tables are also included. A handy reference book for designers and users of transmission equipment. Not new but still standard. *Brad Foote Gear Works.*

IT'S NEW CHECK IT

(16) HYDRAULIC PRESS. "Take the Press to the Job" is the theme of this bulletin announcing a new type of portable hydraulic press. Versatile and rugged, it functions in any position, pulling or pushing. A universal oil-field tool, it has adaptors for almost any kind of job including kelly and drill-stem straightening. *Rodgers Hydraulic, Inc.*

IT'S NEW CHECK IT

(17) OIL-WELL PRODUCTION TOOLS. Three new pamphlets recently issued announce new developments in liner hangers, tubing anchor catchers, and circulation packers. All three have complete specifications and cutaway drawings of constructional details. *Vernon Tool Co., Ltd.*

IT'S NEW CHECK IT

(18) WET SEAL GAS HOLDERS. A 50-page bulletin just published gives a comprehensive picture of the design and construction as well as valuable engineering data on welding technique, pressure, painting surface, corrosion, and general dimensions of all sizes of gas holders up to 10,000,000 cu. ft. It includes numerous cross-sections and tables on the operation and care of wet seal holders. One of the best studies yet on this type of equipment. *Stacey Brothers Gas Construction Co.*

IT'S NEW CHECK IT

(19) VALVE CATALOG. Featuring flow line and drilling valves, this condensed catalog covers the field in a concise manner. Specifications and prices as well as repair parts are included. Two pages are given over to oil savers and their parts lists. *Orbit Valve Co.*

IT'S NEW CHECK IT

(20) NEW ENGINEERING MATERIALS. New products from bouncing putty, the so-called Miracle Plastic, are featured in this new booklet. Silicones are produced in many forms including fluids, greases and compounds, resins and varnishes, and Silastic, the silicone rubber. All these and special formulations of each are described and many uses suggested for them. *Dow Corning Corp.*

IT'S NEW CHECK IT

(21) THE IMPROVEMENT OF METALS BY FORGING. A complete reference data book covering this important metal-working field from design through inspection. Its 35 pages may well become a bible for metal workers. The book itself is well illustrated with pictures of forging operations and contains metallurgical and chemical tables for many of the commoner steels. *The Steel Improvement & Forge Co.*

IT'S NEW CHECK IT

(22) EQUIPMENT FOR CHEMICAL PROCESS PLANTS is a two-color bulletin illustrated with many installation views of the company's equipment. The compressor section displays machines ranging from small air-cooled to large 3,000-hp. models. There are several pages of centrifugal pumps for all services in chemical and process plants as well as cross-sections and schematic drawings in color to show the working of ejectors, barometric condensers, etc. *Ingersoll-Rand Co.*

IT'S NEW CHECK IT

(23) DIESEL ENGINE OVERHAUL. A new, fact-filled booklet, describes in detail fast, simple methods of removing carbon, grease, oil, asphalt, and tar. A procedure is outlined for cleaning and descaling the cooling system. A setup for salvaging parts from wrecked equipment is explained. Chemical methods for removing and preventing rust and for preventing scale are discussed. The booklet is packed with useful information for diesel men. *Turco Products, Inc.*

IT'S NEW CHECK IT

(24) MODERN COMPRESSOR STATION DESIGN is a 12-page reprint of an article by Harold Dawes covering many of the changes in thinking regarding compressor-station design during the last few years. A MUST for pipeliners and a SHOULD for producers and refiners. Just about the latest thing on this subject. *Clark Bros. Co., Inc.*

IT'S NEW CHECK IT

(25) VALVE RECORD SHEETS and valve retirement plan worked out to help prevent costly industrial valve failures by a valve manufacturer. Sample sheets in handy file folder listing valve check points and places for mechanical comment with repair cost analyses. *Jenkins Bros.*

IT'S NEW CHECK IT

(26) BOILERS. New catalog of boilers showing typical installations of high and low-pressure units with specifications and complete details. Twenty attractive pages with pictures of 13 different units ranging in capacity from 200,000 lb. per hour at 450 psi. 650° F. to 2,500 lb. per hour at 100 psi. sat. *Union Iron Works.*

IT'S NEW CHECK IT

R. J. O'CONNELL *R. S. BUBB* *P. W. EBERHARDT*

MEN IN THE NEWS

Raymond James O'Connell has been announced as assistant to the general superintendent of Oklahoma Contracting Co., Inc., of Dallas, Tex. In this capacity, he will be directly in charge of all foreign operations. O'Connell entered the oil business in December 1921 with Humble Pipe Line Co. During 1941-1942 he was loaned to Standard Oil Co. of New Jersey and assisted in organizing and constructing Portland Pipe Line Co. and Montreal Pipe Line Co. Oklahoma Contracting Co.'s South American office is at Caracas, Venezuela.

Appointment of **Robert S. Bubb** as sales promotion and advertising manager of Dresser Manufacturing Division, Dresser Industries, Inc., Bradford, Pa., is announced by **Hector P. Boncher**, general manager.

Paul W. Eberhardt has been elected a vice president of Walter Kidde & Co. His principal duties will include management of domestic sales of the company's fire-fighting equipment in aviation and general industry, together with general supervision of field selling activities.

W. N. (Bill) Bitterman has returned to Bettis Sales Co. as service manager after 3½ years' service with the armed forces. Before entering service, Bitterman was manager of the Bettis store in Lafayette, La. He now is stationed at Houston, Tex.

Appointment of **Charles D. Hawley** as assistant to the general manager of Ethyl Corp. research laboratories at Detroit is announced by **Earle W. Webb**, president of the corporation. **John B. Taylor, Jr.**, has been named to succeed Hawley as assistant director of engineering research.

O. W. Graham and **R. C. Granner** of Engineering Laboratories, Inc., will be in the Los Angeles and San Francisco, Calif., areas the week of January 7 to 15 giving plant demonstrations of the latest model Penetron to those interested. Arrangements are being made for refinery demonstrations through Engineering Laboratories, Inc., West Coast representative **Marshall Brown**, 214 Front Street, San Francisco.

Maj. Charles Wirth, III, has rejoined the staff of the petroleum chemicals division of E. I. du Pont de Nemours & Co. after more than 3 years in the Army.

W. N. BITTERMAN *C. H. HAWLEY* *J. B. TAYLOR*

The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

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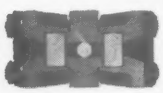

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REFINING

Republic Oil Refining Buys Marketing Company

PITTSBURGH. — W. E. Huston, president of Republic Oil Refining Co., announced here last week that the company had purchased the entire capital stock of Republic Oil Co., a distributing and marketing agency, which handles all sales of the refining company's products. The purchase was made from General Oil Sales Corp., which was the sole owner of Repubic Oil Co. The purchase price was not made public.

Republic Oil Refining Co., which owns and operates a refinery at Texas City, Tex., thus acquired ownership of terminal facilities and widespread retail outlets in a number of southern and eastern states, through which the company will market the products of its refinery direct to the trade.

All of the companies involved in the transaction are identified with the Benedum-Trees organization.

Standard of California Operating Chemical Plant

SAN FRANCISCO.—The million-dollar plant at Standard Oil Co. of California's Richmond refinery to make phthalic anhydride for Oronite Chemical Co., a wholly owned subsidiary, has been completed and production is moving steadily toward full capacity.

Phthalic anhydride is a chemical raw material which has opened a wide field among the uses of petroleum products. The chemical is a basic ingredient for new paints claimed to have exceptional durability; dyes for textiles and leathers; as a plasticizer in plastics and synthetic rubber; in laminates for woods; adhesives for safety glass; insect repellent; in the manufacture of more than 50 chemicals, and to some extent in pharmaceuticals.

The new Richmond plant is the only one in the world making phthalic anhydride from petroleum. All other operating plants for manufacture of phthalic anhydride use naphthalene obtained from coal tars.

Standard of California also announced this week that a newly formed subsidiary, California Asphalt Corp., is preparing to build an asphalt refinery costing $1,000,000 at Willbridge, Ore., 6 miles northwest of Portland. The plant will be the only one of its type in the Northwest Pacific Coast area. Crude oil for processing into asphalt will be shipped by tanker from California.

Fuel Demonstration Plant Replaces Ordnance Works

WASHINGTON. — The $17,500,000 Missouri Ordnance Works, near Louisiana, Mo., which made synthetic ammonia during the war, will be taken over by the Bureau of Mines and converted into a demonstration plant for production of gasoline and oil from coal and lignite. The plant will be transferred from the War Department to the Interior Department. The 390-acre site was selected by the bureau after a survey of 206 proposed locations in 21 coal-producing states.

The plant, Secretary of the Interior Harold L. Ickes said, can be converted to the bureau's purposes

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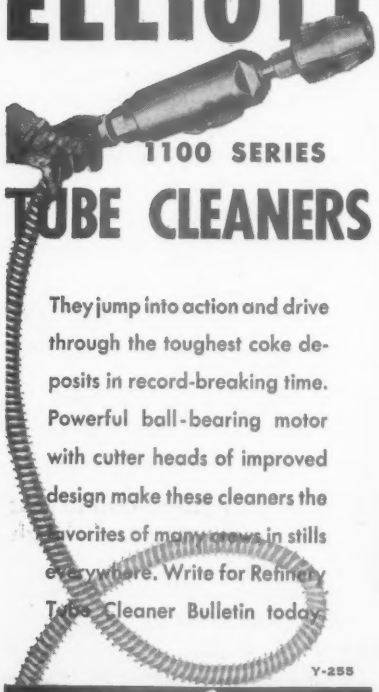

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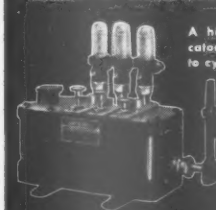

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at a saving of "several million dollars" in construction costs, and speed up the Government's research program on synthetic fuels.

Facilities of the newly acquired plant will be directed to improving methods already developed in this country, and to developing new, and especially cheaper, processes. Engineers and scientists, it was pointed out, will have full benefit of knowledge recently acquired from Germany which had made great progress in the conversion of coal to liquid fuel.

Acquisition of the Missouri site was described as part of a 5-year, $30,000,000 program authorized by the Synthetic Liquid Fuels Act to develop and make available to private industry the technique for converting American coals and oil shales into gasoline.

One Government Plant Sold; Eight Leased

WASHINGTON.—One sale, one commercial lease and seven interim leases of government-owned petroleum properties were reported this week by Reconstruction Finance Corp. in a tabulation covering temporary and permanent disposals of 287 plants built at a cost of $978,000,000.

The single sale was the Terminal Refining Corp. property, Corpus Christi, Tex., which went to that company at the cost price of $1,514,851.03. The Baytown Ordnance Works, Baytown, Tex., producing toluene, has been leased on a month-to-month basis to Humble Oil Co. Original cost of the plant was $13,292,000.

Interim or short-term leases represent continued operation of plants by their wartime lessees.

Included in this group are the Root Petroleum Co. plant, El Dorado, Ark., costing $4,480,000; Continental Oil Co., Ponca City, Okla., costing $11,057,785; Utah Oil Refining Co., Salt Lake City, built at a cost of $15,900,000; and the Eastern States Petroleum Co., Houston, costing $11,949,873, all subject to termination of the leases on 30-days' notice.

Leased subject to termination on 15-days' notice are three carbon black plants, United Carbon Co., Odessa, Tex., built at a cost of $8,978,458; Continental Carbon Co., Sunray, Tex., $2,240,000; and Panhandle Carbon Co., Eunice, N. M., $2,750,000.

In addition, a carbon black plant operated by the Charles Eneu Johnson & Co., Monument, N. M., and located near Hobbs, N. M., was offered last week for sale or lease.

Nazi Chemical-Research Documents Available

WASHINGTON. — Microfilms of 324 research reports, written by chemists in the employ of I. G. Farbenindustrie and covering many fields of chemical research in 10 plants, are available for distribution to the public, Office of Publication Board announces.

The reports, obtained by the military service and released to OPB for distribution, are in the original German. They cover two rolls of microfilm, obtainable upon order at $6 per roll from OPB. Photostatic copies of each report will be available later. The reports cover chemical research in the following works of I. G. Farbenindustrie: Uerdingen, Ludwigshaven, Leverkuson, Frankfurt-Hoechst, Frankfurt-Griescheim, Frankfurt-Mainkur, Wolfen Farben, Merseburg Ammonia, Huels, and Offenbach.

The material provides a useful supplement to the comprehensive economic survey of the operations of the German cartel, covering five rolls of microfilm, recently made available by OPB.

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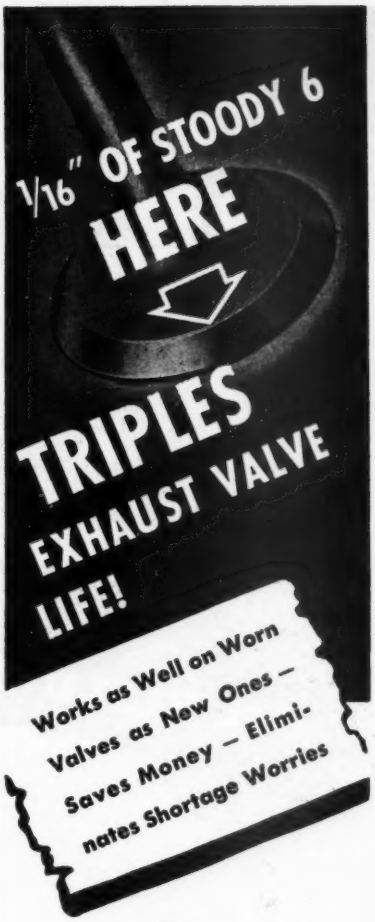
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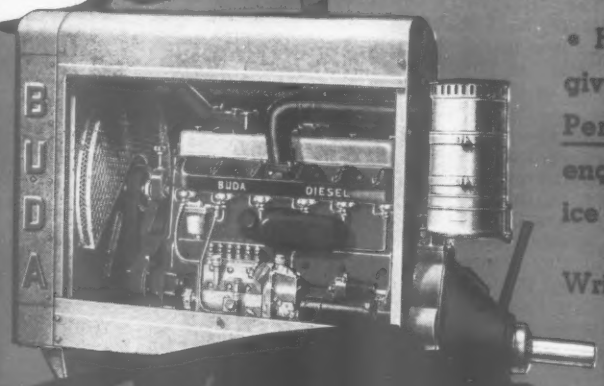

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Natural Gas

Carthage Gas Allowable Raised 100,000,000 Cu. Ft.

An increase of more than 100,000,000 cu. ft. in the daily production of sweet natural gas from the Carthage field of Panola and Harrison counties, East Texas, was authorized last week by the Railroad Commission.

The new order, effective December 1, set daily allowable production at 279,935,097 cu. ft. per day compared to authorized output of 173,103,133 cu. ft. daily in November.

The increase was granted because of continued development of the field and to satisfy expanding markets opened by completion of new transportation facilities.

Southwestern Gas Course To Be Held in April

The Southwestern Short Course, according to recent announcement by the general committee, will be held April 23, 24 and 25 at Oklahoma University, Norman.

At a recent meeting, in Dallas, the general committee elected the following chairmen: R. M. Scofield, Lone Star Gas Co., Dallas, program; C. E. Terrell, Southwestern Natural Gas Co., Birmingham, publications; J. L. Griffin, Northern Natural Gas Co., Omaha, exhibits; Kate A. Niblack, Oklahoma Utilities Association, Oklahoma City, registration and publicity; W. H. Carson, Norman, local arrangements. W. H. Woods, Gulf Oil Corp., Houston, is to serve another year as chairman of the practical methods committee.

Consolidated Gas Seeks Storage Permit

WASHINGTON. — The Federal Power Commission last week received testimony on an application filed by the Consolidated Gas Utilities Corp., Oklahoma City, Okla., for authorization to construct and operate facilities required for the development of an underground gas storage reservoir known as "Sutcliffe." The area covers some 1,200 acres in Wilson and Neosho counties, Kansas and is adjacent to the applicant's Humboldt-Sycamore pipe line system from which gas is delivered for distribution in Chanute, Neodesha and Humboldt and to certain industrial customers.

According to the application the storage project is needed to provide an additional supply of gas during periods of peak demand. The application further states that when restored to the original pressure of 300 psi. the capacity of "Sutcliffe" will be 200,000,000 cu. ft. of gas. Gas obtained from numerous small wells and from Cities Service Gas Co. would be used for storage.

The facilities the company proposes to construct include a maximum of nine injection and withdrawal wells to a depth of about 950 ft., about 1,900 ft. of 6⅝-in. pipe line beginning at the applicant's Humboldt-Sycamore line in Neosho County and extending southeast to a central point of the underground storage area, about 1,500 ft. of 4½-in. pipe to connect the injection and withdrawal wells with 6⅝-in. pipe line, two meter stations and two regulator stations.

Wyoming Gas System Given Operating Permit

WASHINGTON.—A certificate of public convenience and necessity was granted last week to the Frannie Gas Co., Frannie, Wyo., authorizing it to continue operation of its 8-mile, 3-in. gas transmission pipe line extending from the Polecat gas field in Park County, Wyoming, to a point on the Montana-Wyoming state line, and a 5-mile, 2-in. connection to the Yale Pipe Line Co.'s pumping station near Warren, Mont.

Texas-Mexico Gas Line Hearing Resumed

The Federal Power Commission reopened hearings last week on an application of the Reynosa Pipeline Co., Corpus Christi, Tex., to export natural gas from the Rio Grande Valley to Monterrey, Mexico.

The commission several months ago dismissed the application on the grounds that more data should be submitted.

Legal argument on various phases of the project marked the opening of the rehearing. Charles E. McGee, commission attorney, argued that the company should be required to obtain a certificate of convenience and necessity to build the line from La Blanche field in Hidalgo County to Reynosa, Mexico, on the border. From that point it would be transported to Monterrey by a Mexican company.

Counsel for the Reynosa company, James Young, Jr., declined to argue the question whether his client, as an applicant for exploiting gas, should come under the commission's jurisdiction.

Protests to Senators Against FPC Hearings

The Pocahontas Operators Association, over the signature of W. E. E. Koepler, secretary, is memorializing four United States senators with a statement protesting against Federal Power Commission for ordering hearings on individual applications for pipe-line permits. The senators are Carter Glass and Harry F. Byrd of Virginia and Harley M. Kilgore and Chapman Revercomb of West Virginia.

The operators association asserts that the hearings were scheduled "in spite of the fact that the association was given to understand that proceedings in individual cases would be stayed until the general investigations of the natural gas industry and its pipe line transportation facilities were completed. Also a plan would be presented to Congress in lieu of a report of a congressional committee which might have been appointed for this purpose."

Kansas-Nebraska Plans Expansion

The Federal Power Commission has received an application from Kansas-Nebraska Natural Gas Co., Inc., Phillipsburg, Kans., for permit (1) to construct additional facilities in Kansas and Nebraska, including 77 miles of 16-in. and 12¾-in. line and additional compressor facilities to enable it to increase the amount of gas transmitted through its own lines from the Hugoton field, and about 100 miles of branch or lateral lines to serve 16 Nebraska communities; (2) to replace 56 miles of its present pipe-line system with pipe of smaller diameter, and (3) to acquire about 36 miles of branch pipe lines from the Central Electric & Gas Co. to which the applicant sells gas at wholesale. Total cost of the proposed undertaking is estimated at $1,575,000.

The company states it desires to begin construction before March 1946 and to complete it by October 1, 1946, and wishes to consummate the purchase of the facilities from Central Electric & Gas Co. as soon as practicable.

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(3) Hot application of desired coating.
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(5) One spiral wrapping of desired wrapping material.
(6) One spiral wrapping of heavy kraft paper.

SPECIFICATION "B"

INCLUDES
(1) Mechanical cleaning.
*(2) Mechanical priming with desired primer.
(3) Hot application of desired coating.
(4) Hot application of desired coating.
(5) One spiral wrapping of desired wrapping material.
(6) Hot application of desired coating.
(7) One spiral wrapping of heavy kraft paper.

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PIPE LINES

Humble Products 275-Mile Baytown-Dallas System

Humble Pipe Line Co. will start construction early in January for a 275-mile 6-in. products pipe line from the Humble Oil & Refining Co.'s Baytown refinery to a point in the Dallas-Fort Worth area. Total cost of the line and the necessary storage and terminal facilities will be approximately $3,000,000.

Terminals will be located near Houston, Hearne, Waco and in the Dallas-Fort Worth area. The two pump stations located at Baytown and Hearne will be operated by Humble Pipe Line Co. while the sales department of Humble Oil & Refining Co. will operate terminals and distribution facilities.

Rocky Mountain Field Outlets Are Considered

Texas Pipe Line Co. is completing a 10-mile 6-in. loop on its 15-mile 4-in. crude-oil line from the Wilson Creek field to Iles, Colo., where it connects with a Utah Oil Refining Co. line. Deliveries are made to The Texas Co.'s refinery at Craig, Colo., from the Utah system.

The California Co. and affiliated Standard Oil Co. of California interests are reported to be considering the building of a line from the Rangely field, Colorado, to San Francisco.

A plan has been discussed by Wasatch Oil Refining Co., Sharples Co., and Idaho Refining Co. for the building of a 200-mile 14-in. crude-oil line from the Rangely field to the Wasatch refinery at Salt Lake City.

Joint Operation of WEP Is Legally Permissible

The Department of Justice does not regard the federal antitrust laws as barring the purchase and operation of the facilities of War Emergency Pipelines, Inc., by a group of companies, according to recent letter from Tom C. Clark, United States attorney general to Sen. Joseph C. O'Mahoney.

The attorney general pointed out that to escape antitrust law violation, however, such operation would have to be on a strict common-carrier basis, with service available on equal, nondiscriminatory and reasonable terms to all comers.

In recent hearings on disposal of the big inch, W. Alton Jones, president, Cities Service Co., who headed the group operating WEP, testified that these companies hesitated to contemplate joint operation in peacetime for fear of violating the antitrust laws.

Purchase of the WEP lines is reported to be under consideration by a New York syndicate and two groups in Texas.

Stanolind Files New Tariffs

The Interstate Commerce Commission reported last week that Stanolind Pipe Line Co., Tulsa, has filed two new rate schedules for shipments between Wyoming and Illinois.

A rate of 37 cents a barrel became effective November 20 between Buffalo, Elk Basin, Kirby and Oregon, Wyoming, and Hartford, Ill. Effective November 1, also at the rate of 37 cents a barrel, was

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for faster digging of trenches for crude lines. Digs trench 24" to 39" wide — up to 8½' deep.

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a tariff between the same points in Wyoming and Wood River, Ill.

Effective December 1, the company cancelled tariffs between Lance Creek station, Wyoming, and these points: Sugar Creek, Mo., 23 cents, and Wood River, Ill., 27 cents.

Gulf Loops Are Half Completed

Construction of 470 miles of 8-in., 10-in., and 12-in. loops for Gulf Refining Co. between West Texas and Port Arthur, Tex., is more than half completed. This project on which work started early in October is for the purpose of increasing the capacity of the system by 30,000 bbl. to attain a total capacity of 115,000 bbl. daily at a cost of approximately $8,000,000 in order to provide for large shipments of sweet crude from the Keystone Ellenburger pool.

Empire Pump Units At Intermediate Station

Inability to obtain delivery on equipment for the Sour Lake pump station and the intermediate station on the Sour Lake-Lake Charles line of Empire Pipeline Co. has resulted in a change in plans for the two expansion projects. Motor-driven pumps will be substituted at the intermediate station for the diesel equipment originally planned.

Pending delivery of diesel-powered pump equipment at the Sour Lake station, one electric motor-driven centrifugal pump will be installed immediately. Upon delivery of the diesel-driven unit, the motor-driven equipment will be used as a stand-by pumping facility.

Volume and Income of 47 Pipe Lines Declines

Interstate Commerce Commission figures issued last week disclose that the 47 largest pipe-line companies of the United States experienced in the third quarter of 1945 the first reduction in earnings and volume of business from a year earlier that had been recorded in recent years.

These companies reported transportation revenue for the period of $72,104,368, a reduction of 3 per cent from the 1944 period. They reported oil originated on line and received from connections at 560,913,766 bbl., a reduction of 1.7 per cent.

The two leading middle western refined products pipe-line systems showed increases in both categories. Great Lakes Pipe Line Co. had 2,722,593 bbl., up 9.8 per cent, and $6,328,532, up 10.4 per cent. Phillips Pipe Line Co. had $1,848,125, up 10.4 per cent, and 4,626,541 bbl., up 14.5 per cent.

Among the crude oil carriers, the companies running against the trend by reporting increases included Interstate Oil Pipe Line Co. (up in volume but off in revenue), Standish Pipe Line, Texas-Empire Pipe Line, Texas-New Mexico Pipe Line and Texas Pipe Line companies. Some of these lines had expanded their systems substantially between these quarters.

Colorado Interstate to Increase Line Capacity

DENVER.—Colorado Interstate Gas Co., which supplies central Colorado cities and Cheyenne, Wyo., with natural gas from Northwest Texas, expects to complete installations costing $750,000 by January 1 to increase pipe-line capacity by 8,000,000 cu. ft. per day. Present capacity of the 20-in. line from Colorado Springs to Denver is 88,000,000 cu. ft. at 14.65 lb. pressure.

Improvements include four compressors of 800 hp. each, 10 miles east of Colorado Springs, and installation of other compressors at six stations between Bevins, Tex., and Devine, Colo. Stearns-Rogers Manufacturing Co. has the contract. Contract with Public Service Co. of Colorado expires a few months after the distributing company's franchise in Denver expires in 1947.

PIPE LINES

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CONSULTING ENGINEER

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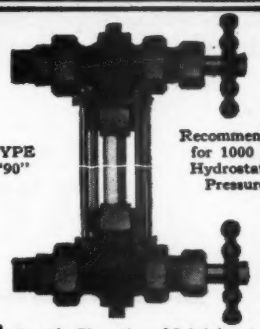

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Made of Chromium-Molybdenum alloy temperature resisting steel, extra heavy throughout and stainless steel trimmed. Positive automatic shut-off; stainless steel balls shut off the flow of liquid if glass breaks. Regrinding removable seats, heavy duty stuffing boxes, union connections. Conform with A.P.I.—A.S.M.E. requirements.

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WHEN YOU WANT The Best IN PIPELINE CONSTRUCTION

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Replace Old Style Expensive Methods

TUBING Eliminator

SAVES TUBING COSTS

CUTS MAINTENANCE

An operator in Kansas, reports a saving of $16,275.00 on fifteen wells through use of NORRIS TUBING ELIMINATORS. Average depth of wells 3,300 feet. This same company reports further savings of $40.00 per well, each time it was necessary to pull the well. On deeper wells, saving is proportionately greater.

Similar savings are reported by many major and independent oil companies after rigid tests made under varying field conditions. Reports from producers who are using NORRIS Tubing Eliminators, indicate they are being accepted as Standard Equipment.

When a NORRIS Tubing Eliminator is installed, you have only a rod job to service the well – NO wet string of tubing to pull. Well casing remains full of fluid at all times and when pump is serviced and put on beam it will immediately start fluid to tanks.

GUARANTEED – **Behind each NORRIS Tubing Eliminator stands the NORRIS Label of Quality, known and accepted throughout the oil world as the symbol of finest material and workmanship. NORRIS standards assure that the best quality will be present in each Tubing Eliminator bearing the NORRIS Label. The company guarantees Quality Manufacturing—both as to materials and workmanship.**

JAY TOOL TYPE, illustrated in set position with seating nipples to use in connection with insert type pump.

THE NORRIS TUBING ELIMINATOR CAN BE INSTALLED AT HIGHER FLUID LEVELS WITH USE OF ANCHOR.

For complete information about this revolutionary forward step in oil production –
SEND FOR BULLETIN NO. 34

CONVENTIONAL TYPE, illustrated in running position with common working barrel assembly.

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Exploration and Drilling

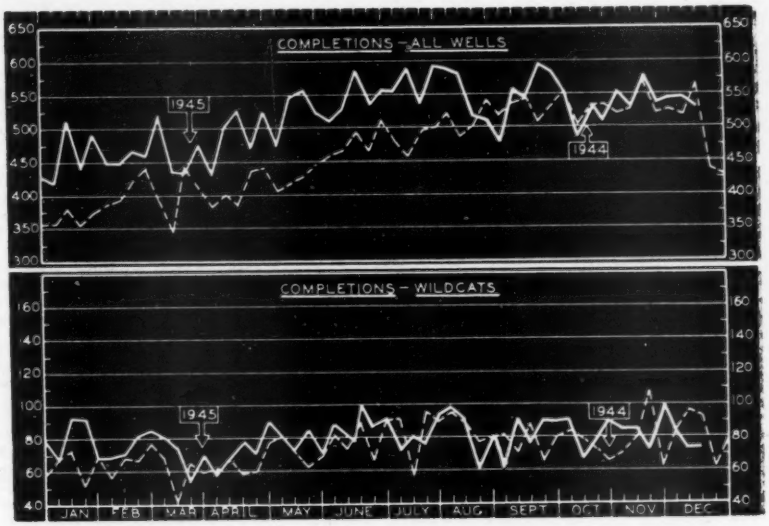
Week's Highlights

ARE the developments in Cimarron County in the Oklahoma Panhandle going to result in: (a) another Hugoton gas field; (b) another Amarillo oil and gas region; or (c) just another flash in the pan? These are some of the questions going around among geologists and company officials, as the results of two more wells are known.

In the Keyes area, Pure Oil Co. is completing its fifth test, 1 Johnson, SW SE 12-5n-7ecm, swabbing 50 bbl. of oil in 8 hours from the same basal Pennsylvanian sand (some call it Cherokee) in which Pure has previously completed two gas wells, one oil well and one dry hole, all within an area about 8 miles east and west by 3 miles north and south. The previous wells were: 1 Cox, SE SW 16-5n-8ecm, 19,000,000 cu. ft. of gas; 1 Rose, NE SW 26-5n-8ecm, 14,000,000 cu. ft. of gas; 1 State, NE NW 7-5n-8ecm, flowed 100 bbl. daily of 38° gravity oil; and 1 Alliance Insurance Co., NE NE 9-5n-7ecm, dry hole.

Thirteen miles south of Pure 1 Cox, Stanolind Oil & Gas Co. 1 Omohundro, NE SW 21-3n-8ecm, has been completed in what seems to be the same basal Pennsylvanian sand, at about the same depth, 4,801-22 ft., for 1,560,000 cu. ft. of gas. Already many of the optimists are considering the whole intervening territory as proven for gas.

Similarities both to Hugoton and to the Amarillo area are being pointed out by advocates of the various potentialities. Actually, since Hugoton and the Amarillo areas will probably connect as far as gas



Solid line charts current weekly completions—service wells included

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 15, 1945

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1945				
	Comp.	Oil	Gas	Dry	Footage	1945	1944	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	28	14	0	*14	48,531	1,416	1,525	0	0	0	0	0	0	0	0	0	0
Pennsylvania	73	31	6	†36	118,049	3,867	3,989	0	0	0	0	0	0	0	0	0	0
West Virginia	11	0	8	3	35,024	777	858	0	0	0	0	0	0	0	0	0	0
Ohio	15	3	7	5	37,273	958	986	0	0	1	1	2	0	0	15	62	77
Indiana	5	3	0	2	11,062	189	242	0	0	0	0	0	7	0	0	25	32
Kentucky	13	7	1	5	23,377	552	736	0	0	0	1	1	23	0	4	52	79
Illinois	34	24	0	10	82,895	1,739	1,905	0	0	0	3	3	51	0	0	300	351
Michigan	17	6	3	8	43,852	734	658	0	0	0	6	6	11	0	7	275	293
Kansas	41	23	6	‡12	136,001	1,704	1,778	0	0	0	3	3	35	0	15	325	375
Neb., Mo., Iowa	0	0	0	0	0	29	41	0	0	0	0	0	0	0	0	18	18
Oklahoma	43	25	4	14	167,882	2,312	1,794	2	0	0	7	9	79	3	18	346	446
Texas	154	90	9	55	672,532	6,901	5,475	2	0	0	30	32	200	16	54	1,235	1,505
North Central	54	28	0	‡26	142,181	2,128	1,442	1	0	0	12	13	72	0	5	439	516
West	28	25	0	3	141,723	1,664	1,537	0	0	0	2	2	53	1	0	240	294
Panhandle	7	5	2	0	21,706	518	297	0	0	0	0	0	0	0	1	7	8
Eastern	14	9	2	3	67,894	377	313	0	0	0	1	1	6	8	2	85	99
Gulf Coast	37	18	5	14	238,926	1,594	1,235	0	0	0	9	9	54	6	35	286	381
Southwest	14	5	0	9	60,102	497	651	1	0	0	6	7	15	1	11	178	205
Louisiana	28	13	8	7	121,180	1,060	788	0	0	0	3	3	32	4	6	119	161
Northern	18	7	6	5	55,684	464	314	0	0	0	2	2	8	1	6	70	85
Southern	10	6	2	2	65,496	596	474	0	0	0	1	1	24	3	0	49	76
Arkansas	10	4	0	6	26,222	177	207	0	0	0	5	5	2	0	0	40	42
Mississippi	2	1	0	1	10,462	347	154	0	0	0	1	1	6	0	0	115	121
Southeastern States	0	0	0	0	0	57	51	0	0	0	0	0	1	0	1	37	39
Montana	1	1	0	0	2,905	300	341	0	0	0	0	0	10	0	0	24	34
Wyoming	5	5	0	0	19,773	219	176	0	0	0	0	0	18	0	1	44	63
Colorado	3	1	0	2	20,266	55	35	0	0	0	2	2	1	0	1	13	15
Utah	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
New Mexico	8	6	0	2	25,207	398	388	0	0	0	1	1	11	0	6	62	79
California	38	23	2	13	151,645	2,127	1,939	0	0	0	5	5	4	0	2	223	229
Total United States	529	280	54	195	1,754,138	25,919	24,044	4	0	1	68	73	491	23	131	3,315	3,960
Total previous week	548	292	68	188	1,902,168	25,390	23,538	7	1	4	60	72	487	23	130	3,247	3,887
Total Dec. 16, 1944	593	310	73	210	1,928,430	24,044	17,383	14	0	5	74	93	444	26	122	3,148	3,740

Service wells included: *14, †31, ‡1.

is concerned, the argument is somewhat academic. However, it is noted that in Cimarron County the formation pressure, at 850 psi., is only about 40 per cent of normal. Hugoton and Amarillo averaged between 30 and 35 per cent of normal. That the latter two produce from well up in the Permian, as against basal Pennsylvanian for Cimarron County, is merely something else about which to speculate.

The small amount of oil that has been produced from Pure's first oil well, (something like 1,000 bbl. in storage), is reported to have shown a high paraffin content, with a fairly high congealing point, resulting in clogged tubing. This of course was also true of the early wells in Amarillo.

SOUTH LOUISIANA

Production Opened on North Flank of Gueydan

NEW ORLEANS. — Magnolia Petroleum Co. 2 Simon estate, opened production on the north flank of Gueydan fields of Acadia Parish and Vermilion Parish, flowing 325 bbl. of 40-gravity oil daily through a 7/64-in. choke with 5,150 lb. pressure on the tubing. Drilled to a total depth of 10,843 ft., well was completed through 24 perforations at 10,790-795 ft., in solid oil sand at 10,786-800 ft. Gas-oil ratio is 1,690 to 1.

A thick sand section in the Wilcox showing 39-gravity oil is reported picked up by Magnolia 1 J. B. Morein, a wildcat test in 5-5s-1e, Evangeline Parish, 6 miles south and 3 miles east of the Pine Prairie field. Top of the Wilcox sand was encountered at 11,511 ft., and it is solid to approximately 11,555 ft. Another sand section was cored around 11,575 ft. This test is credited with about 10 ft. of sand in the Cockfield showing gas and condensate. Cockfield was topped at 8,940 ft.

There were 14 new locations reported this week, 4 are 12,000-ft. tests and 3 are 11,000-ft. tests, with 2 wildcats located 1 each in LaFourche and St. Bernard parishes. Of the 10 completions only 1 was a wildcat failure in Avoyelles Parish.

SOUTH LOUISIANA WILDCAT FAILURES

Avoyelles Parish: Don Crosby Drilling Co. and Industrial Crude, Inc. 1 Snowden estate, 22-3n-5e, dry at 8,049 ft.

EASTERN TEXAS

Hopkins Wildcat Drilling Ahead After Small Show

DALLAS.—Delta Drilling Co. 1 Livingston, Nacogdoches University Survey, wildcat 3 miles southeast of Reilly Springs, southern Hopkins County, ran a drill-stem test from 8,013-33 ft. and recovered a small show of gas and distillate. The show was insufficient for commercial production so operator was drilling below 8,080 ft. Magnolia Petroleum Co. 2 Bolton, Block 80, Henry Bond Survey, Trinity County wildcat 3 miles west of Glendale, made a drill-stem test from 10,624-647 ft. and recovered salt water with a slight show of gas. It was being deepened to 13,000 ft.

Hiawatha Oil Co. (J. C. Benedum) 1 Pickering, W. J. Brittain Survey, Shelby County, southeast of Patroon and 3,000 ft. northwest of M. E. Davis (Benedum) 1 Pickering, a dry hole, recovered 100 ft. of gas-cut drilling mud on a drill-stem test from 3,595-3,613 ft. It was coring below 3,640 ft. Paul B. Scott 1 Fannie B. Irwin, Mary Keys Survey, Hunt County wildcat, is dry at 4,387 ft. Paluxy was topped at 4,370 ft. Unsuccessful efforts to recover lodged tubing led to junking of hole of Sinclair Prairie Oil Co. 1 Shofner, N. T. Dickerson Survey, deep test in the Chapel Hill area of Smith County. Total depth is 13,557 ft.

Hawkins field, Wood County, had four completions this week and Calvert field, Milam and Robertson counties, had three completions. Carthage field, Panola County, reported two new locations.

EASTERN TEXAS WILDCAT FAILURE

Robertson County: C. L. Brown 1 P. C. Gibson, Jesse Webb Sur., 1½ mi. NW Calvert, dry at 2,506 ft.

PERMIAN BASIN

Andrews Wildcats Show Sulfur Water on Tests

MIDLAND.—Sinclair Prairie Oil Co. 1 H. G. Bedford, Section 10, Block 73, Public School Lands, wildcat 1¼ miles southeast of Shell Oil Co. and The Texas Co. 1 Ratliff & Bedford, opener of the Bedford pool in southwestern Andrews County, appeared to be a failure in the Ellenburger. On a 100-minute drill-stem test from 11,450-528 ft. recovery was 1,320 ft. of sulfur water with no shows of oil. The test was through a ¾-in. choke under a 4,500-ft. water blanket. Elevation is 3,223 ft. An electric log survey was to be made. Magnolia Petroleum Co. 1-A E. P. Cowden, Section 7, Block A-55, Public School Lands, west offset to Magnolia and Humble Oil & Refining Co. 1 Cowden, opener of the Dollar Hide pool in southwestern Andrews, took a 65-minute drill-stem test from 7,489-7,550 ft. and recovered 180 ft. of drilling mud and 120 ft. of sulfur water. There were no oil stains. It was drilling ahead at 7,550 ft. in lower Permian lime. Stanolind Oil & Gas Co. 1-BB University, Section 17, Block 11, University lands, is the second producer in the Three Bar pool in southwestern Andrews. It is ⅜ mile from Stanolind 1-D University, the discovery well. It flowed 271 bbl. of 42° gravity oil in 24 hours through perforations from 8,140-96 ft. and 8,216-50 ft.

Stanolind 1 Jessie Mae Williamson, Section 5, Block 45, T-1-N, T&P Survey, wildcat seeking Ellenburger production northwest of the Goldsmith pool, Ector County, recovered 150 ft. of drilling mud with a scum of oil on a 75-minute drill-stem test from 8,470-8,525 ft. On a later drill-stem test from 8,478-8,565 ft. on the lower Devonian, at the end of 3 hours recovery was 210 ft. of heavily oil and gas-cut drilling mud. It was being drilled ahead. Cities Service Oil Co. 1-C E. R. Thomas, Section 6, Block 45, T-1-S, T&P Survey, is a 3/7-mile northwest extension to Ellenburger production in the TXL field, Ector County. It was completed with a natural daily flow of 2,067 bbl. of 41.7° gravity oil.

Stanolind 1 Mack Taylor, Section 8, Block B-3, Public School Lands, 1-mile east outpost to the Keystone area of Winkler County, cored the Ellenburger from 10,232-250 ft. and recovered 4 ft. of gray medium crystalline with slight oil stains. A drill-stem test will be run on the section. Continental Oil Co. 1 F. H. Scott, Section 33, Block 33, H&TC Survey, wildcat 5 miles southeast of Barstow, Ward County, drilled saturated section from 4,835-50 ft. in the Delaware. It was drilled to 4,869 ft. where it bailed at the rate of 20 bbl. of oil daily. It was preparing to shoot the pay section from 4,835-73 ft. with 40 quarts.

Fullerton field, Andrews County, Garza field, Garza County, and Sharon Ridge field, Scurry County, each had three completions this week while Sand Hills-Tubb field, Crane County, and Slaughter field, Cochran County, each had two. Welch field, Dawson County, reported eight new locations and Fullerton field three.

WEST TEXAS WILDCAT FAILURES

Andrews County: Sinclair Prairie 1 George

DAILY AVERAGE PRODUCTION FOR WEEK

	Dec. 15 crude oil	Bureau of Mines demand forecast	State allowable	Dec. 8 crude oil
Alabama	150	400	.....	700
Arkansas	75,900	83,273	78,397	76,000
California	846,950	850,000	824,000	837,250
Colorado	19,700	20,000	.....	19,050
Eastern	58,900	65,200	.....	63,400
Florida	100	100	.....	100
Illinois	208,800	213,000	.....	204,800
Indiana	12,950	13,500	.....	12,500
Kansas	264,850	268,000	255,000	242,150
Kentucky	28,750	29,000	.....	29,950
Louisiana	371,450	365,000	406,135	370,800
North Louisiana	76,150	.....	.....	75,500
South Louisiana	295,300	.....	.....	295,300
Michigan	48,900	47,000	.....	43,100
Mississippi	53,600	48,000	.....	*54,850
Montana	22,950	22,000	.....	22,950
Nebraska	750	800	.....	750
New Mexico	102,000	102,000	104,000	102,000
Oklahoma	387,500	388,000	388,000	388,000
Texas	1,918,900	1,940,000	1,938,369	1,918,900
East Texas	307,000	.....	.....	307,000
East Central Texas	130,300	.....	.....	130,300
North Central Texas	149,650	.....	.....	149,650
Texas Panhandle	81,000	.....	.....	81,000
West Texas	465,800	.....	.....	465,800
Southwest Texas	314,550	.....	.....	314,550
Texas Gulf Coast	470,600	.....	.....	470,600
Wyoming	85,600	92,000	.....	85,850
Total United States	4,508,700	4,542,000	.....	*4,473,100
Change from prev. week, up	35,600			

Total production January 1-December 15, 1945 ..... 1,632,638,225 bbl.
Same period last year ..... 1,597,376,330 bbl.
*Revised.

F. Ratliff, Sec. 25, Blk. 73, PSL Sur., 5½ mi. SE Shell and Texas 1 Ratliff & Bedford, elev. 3,256 ft., Montoya 9,840 ft., Simpson 10,138 ft., Ellenburger 10,910 ft., dry at 10,995 ft.

Pecos County: Atlantic 1 Iowa Realty, Sec. 27, Blk. 10, H&GN Sur., 2 mi. NW Heiner pool, elev. 2,550 ft., Devonian 5,900 ft., dry at 6,302 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Stanolind Oil & Gas Co. 1 Mascho Unit, 31-21s-34e, wildcat 4½ miles southwest of the Eunice field, Lea County, was dry at 4,308 ft. in lime. It showed sulfur water on a drill-stem test from 4,238-4,308 ft. No shows of oil or gas were encountered. Humble Oil & Refining Co. 1-B Federal-Leonard, 12-26s-37e, in Dublin area of Lea County, ½ mile north of 1 Federal-Leonard, first Ellenburger producer in New Mexico, was drilling below 8,388 ft. in shale. Humble 1 S. H. Cooper, 23-24s-36e, proposed 7,500-ft. wildcat in the Cooper shallow area in southeastern Lea, was drilling below 6,215 ft. in sandy lime and shale. Skelly Oil Co. 3-A Baker, 26-22s-37e, 1½ miles west of the discovery lower Permian producer in the Drinkard field in southeastern Lea, shut down at 7,965 ft. in Simpson lime and shale for machinery repairs. A nearby wildcat went into granite before drilling as deep.

Lea County had four field completions this week. Eddy County had two. Lea County reported three new field locations and Eddy County had two.

SOUTHEASTERN NEW MEXICO WILDCAT FAILURE

Eddy County: J. L. McGurt 1 Maude Simpson, 20-21s-37e, 3 mi. NE Carlsbad, dry at 880 ft.

MICHIGAN

Deep River Field Gets Two Large Wells

SAGINAW.—Getting better than 50-50 results, Michigan oil and gas operators listed six new oil wells and three gas producers among 17 completions in the past week as 14 new locations in nine counties were announced.

New initial potential was 3,900 bbl. a day, chiefly because of two new gushers which came in for 75 and 80 bbl. per hour in Arenac County's Deep River field. Both wells are in Section 15; a third completion in the same section was dry. Six of the dry holes were wildcat tests, all unsuccessful. Gas wells included one completed in Gilmore Township, Isabella County, after the test for oil halted at 4,091 ft. and the hole plugged back to 1,569 ft.

The new drilling locations include four for Arenac County, two each for Allegan and Bay, one each for Van Buren, Ottawa, Osceola, Tuscola, Midland and Bay.

MICHIGAN WILDCAT FAILURES

Allegan County, Monterey Township: W. Spencer Cook 1 Richard Brower, NW SW NW 14-3n-13w, dry in Traverse limestone, TD 1,744 ft.

Clare County, Freeman Township: Ashby Drilling Co. 1 E. C. Weigert et al, SW NE SE 25-18n-6w, dry at 1,513 ft.

Isabella County, Broomfield Township: J. V. Wicklund Development Co. 1 William Lueder, SE SW NW 13-14n-6w, dry in Dundee, TD 3,849 ft.

Lake County, Pinora Township: H. E. Bell 1 Harley Kadwell, NW NW NW 29-16n-11w, dry in Monroe, TD 3,633 ft.

Van Buren County, Columbia Township: W. D. Gannett 1 Dr. Keefe, SW SW SE 8-1s-15w, dry in Traverse limestone, TD 1,152 ft.

Lawrence Township: Stuart L. Godfrey 1 W. Koselink et al, NW NW NE 30-3s-15w, dry in Traverse limestone, TD 1,016 ft.

TEXAS GULF COAST

Harris County Deep Test Down to 15,452 Ft.

HOUSTON.—Humble Oil & Refining Co. 10 Edward F. Milo, C. N. Pillot Survey, the deepest active test in the Gulf Coast district, continues to seek deep production in the Tomball pool of Harris County. The 5½-in. casing has been set to a depth of 10,241 ft., with total depth at 15,452 ft. in hard sand and shale streaks. The company has not released any information relative to any shows which might have been encountered in the deep test which originally was scheduled as a 13,000-ft. exploration.

Harris County's other deep operation, The Texas Co. 1 Bender, in T. W. Marshall Survey, in the Humble area, is reported drilling ahead from 12,750 ft. in sand and shale with hard streaks.

L. D. Cain 1 C. W. Harrell, deep test in the Goose Creek field area, Harris County, William Scott Upper League, has been junked in top of the Vicksburg with total depth at 6,612 ft. Originally scheduled to go to dome material, or 7,500 ft., operators encountered difficulties when pipe became stuck at the bottom, and derrick was pulled in.

Continental Oil Co. 1 G. M. Brunner, wildcat in the Samuel Isaacs Survey, Abstract 35, 4 miles northwest of Richmond, in Fort Bend County, is dry at a total depth of 8,455 ft. A sand stringer in the Frio which kicked and cut the drilling mud was recorded but electrical log indications were not sufficient to warrant setting casing.

Humble 2 E. L. Bender et al, wildcat test in the Rayford area of Montgomery County School Land Survey 2, Abstract 351, is considered dry after failing to recover any shows of oil from a series of tests made through perforations in the Cockfield at 5,940-60 ft.

Jordan Drilling Co. 1 Lynch Davidson & Co., wildcat 2½ miles west of Corrigan, north of Bear Creek in Polk County, is dry at a total depth of 6,503 ft.

Eighteen new locations were reported this week seven being wildcats, located two each in Chambers, Jackson and Wharton counties, and one in Newton County. Of the 24 completions reported, 12 are oil wells, 2 gas and 10 dry. Seven of the dry holes are wildcats, two in Jackson County and one each in Brazoria, Colorado, Fort Bend, Montgomery and Wharton counties. Harris County led with four completions, and Brazoria and Chambers counties shared second place with three each.

UPPER GULF COAST TEXAS WILDCAT FAILURES

Brazoria County: Windsor Oil Co. 1 Ernest L. Croix, ACH&B Survey, Tract 18, 4 mi. E Arcola, dry at 6,151 ft.

Colorado County: Jack W. Frazier 1 McLane & Johnson, I&GN Survey, Abst. 290, 10 mi. W Garwood, dry at 6,188 ft.

Fort Bend County: Continental Oil Co. 1 G. M. Brunner, Samuel Isaacs Survey, Abst. 35, 4 mi. NW Richmond, dry at 8,455 ft.

Jackson County: Wirt Franklin Petroleum Corp. 1 I. B. Clements, T. H. P. Heard League, 2 mi. SE Cordele, dry at 2,800 ft.

Jackson County: A. H. and C. L. Rowan 1 L. Ranch, I&GN Survey, 2 mi. S La-Ward, dry at 7,010 ft.

Montgomery County: Humble Oil & Refining Co. 2 E. L. Bender et al, Rayford area, Montgomery County School Land Survey 2, Abst. 351, dry at 7,554 ft.

Wharton County: Wirt Franklin Petroleum Corp. 1 Minnie Howell, ETRR Survey 75, 2 mi. S Hillje, dry at 7,300 ft.

SOUTHWEST TEXAS

Two New Productive Areas Found in Kleberg County

CORPUS CHRISTI.—Humble Oil & Refining Co. opened new production in Kleberg County, 4 miles southwest of Kingsville in Santa Gertrudis Grant. The producer is 1 King Ranch-Monte Negra, which flowed a potential of 168 bbl. per day through a ½-in. choke through 24 perforations at 7,065-73 ft. Tubing pressure was 1,025 lb., gas-oil ratio 645 to 1, gravity 38 degrees, no water. Total depth is 7,763 ft., with 5½-in. casing set to 7,149 ft.

Also in Kleberg County, Humble 1 King Ranch-Borregas, opened new production about 8½ miles southwest of Kingsville. On a test through perforations 6,992-95 ft., the well flowed at the rate of 104 bbl. per day through a ½-in. choke, tubing pressure 1,250 lb., gas-oil ratio 3,100 to 1. On previous test in perforations 6,889-95 ft., test had flowed at the rate of 108 bbl. per day through a ½-in. choke, tubing pressure 1,350 lb. Total depth is 8,549 ft., with 5½-in. casing set to 6,956 ft. Operators are continuing to test.

Mills Bennett 1 Martha Berger et al, a wildcat in J. M. Uranga Grant, Ragley Subdivision, Section 19, 2 miles southwest of Tuleta, blew out while waiting on cement to set with 7-in. casing set to 8,000 ft. Total depth is 8,001 ft. The blow was controlled and the well shut in but it could not be killed so operators are preparing to snub in tubing for a check on what happened down the hole. A drill-stem test in the Slick at 7,895-7,905 ft., prior to setting pipe, had recovered gas-condensate.

There were 29 new locations reported during the week, 12 being wildcats, located 3 in San Patricio County and 1 each in Bexar, Jim Hogg, Jim Wells, La Salle, Lee, McMullen, Medina, Starr and Webb counties. Of the 27 completions 9 are wildcats, 8 dry and 1 oil discovery in Starr County. Duval County received the greatest activity with five completions reported.

SOUTHWEST TEXAS SUCCESSFUL WILDCATS

Starr County: New oil pool, Parsons field—The Harrus Syndicate 1 M. M. Garcia, Porcion 91, Block 26, 15 mi. NE of Rio Grande City, TD 4,520 ft., perf. 56 holes 3,498-3,512 ft. Lower Frio, top sand 3,498 ft., PT 124 bbl. per day through a ½-in. choke, gas-oil ratio 276 to 1, tubing pressure 380 lb., casing pressure 1,020 lb., gravity 41 estimated, no water.

SOUTHWEST TEXAS WILDCAT FAILURES

Calhoun County: Salt Dome Corp. 1-176 State of Texas, San Antonio Bay, State Tract 176, 11 mi. SE of Seadrift, dry at 6,515 ft.

Duval County: Gravis & Mitchell 1 S. Hinojosa, A. M. Perez Survey 71, 12 mi. SW San Diego, dry at 6,006 ft.

Sid Katz 1 W. R. Peters, Survey 40, 10 mi. SW Freer, dry at 2,785 ft.

C. S. Sollars et al Alonzo Taylor, El Mesquite Survey, Block 49, 7 mi. N Hebbronville, dry at 4,016 ft.

Refugio County: Pan Oil Co. 1 Ernest Haertig, Johnson & Pugh Subdivision, Bonnie View Ranch, 8 mi. SE Woodsboro, dry at 5,510 ft.

Starr County: Mission Oil & Gas Co. 1 Starr Land & Cattle Co., Jefferies-Lambeth Subdivision, Block 62, Porcion 89, 12 mi. W Rio Grande City, dry at 2,803 ft.

Zimmerman & Brock 1 Anna M. Kel-

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T. J. Cullen, Bakersfield, California
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sey, Porcion 76, Block 12, Kelsey Subdivision, 3½ mi. NW Rio Grande City, dry at 3,202 ft.

Webb County: Nick C. Manetas 1 V. Villarreal et al, Lease 1089, 3½ mi. E Oilton, dry at 2,932 ft.

N. CENTRAL TEXAS

New Production Opened In Sivells Bend Area

WICHITA FALLS. — Mid-Continent Petroleum Corp. 1 J. V. Morris, S. Gann Survey, 1 mile northeast of Sivells Bend area, Cooke County, drilled plug on 5½-in. casing at 6,895 ft., displaced mud with water and the well cleaned itself in 35 minutes. It was turned into tanks after flowing into pits for 3 hours, the well made 75 bbl. of oil the fourth hour and 80 bbl. the fifth hour. Total depth is 6,909 ft. Standard Oil Co. of Texas 2 Beasley, John McKerley Survey, ½ mile west of Sivells Bend field, on a drill-stem test from 6,892-6,903 ft. recovered 1,080 ft. of oil and 30 ft. of oil-cut mud at the end of 7 minutes after showing gas at the surface in 6½ minutes. Sun Oil Co. 1 Kate Allen Heirs, S. Gann Survey, has the fourth pay for Sivells Bend pool. It has been completed to flow 142.74 bbl. of 36° gravity oil in 14 hours through ⅜-in. tubing choke through perforations from 5,280-5,300 ft.

National Associated Petroleum Co. 1 R. R. Alexander, A. Buffington Survey, Montague County, wildcat 2 miles south of Nocona, is dry at 6,413 ft. in hard lime after running electrical survey. Continental Oil Co. 1 George Jarrell et al, Section 3433, TE&L Survey, wildcat 5 miles southwest of Bowie, Montague County, drilled conglomerate showing oil at 5,715-34 ft. where a drill-stem test will be run. Caddo was topped at 5,705 ft. Continental 1-C Heard, Section 3222, TE&L Survey, Clay County wildcat 3 miles southwest of Buffalo Springs, drilled plug from 7-in. casing at 6,468 ft., displaced mud with water and swabbed out water load. The test was showing some gas but no oil as it continued to swab 3,000 ft. from the surface.

Electra field, Wichita County, had 11 completions this week and Burk field, Wichita County, had three. Cooke County reported nine new field locations and Montague and Wichita counties, five each.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCAT

Young County: New oil pool—Robertson Drilling Co. 1 N. Burch et al, Sec. 466, TE&L Sur., 3 mi. N and W Graham, elev. 1,114 ft., pumped 46 bbl. day, perf. 3,794-3,814 ft. Strawn, gravity 39.9, gas-oil ratio 150 to 1, TD 4,791 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Henry Craig 1 Katherine Atchley, Sec. 5, BBB&C Sur. A-46, 3 mi. N and E Olney, dry at 1,200 ft.

Geo. W. Strake and Fain-McGaha 1 J. F. O'Donohoe, Sec. 95, ATNCL Sur., 6 mi. S and 2 mi. E Mankins, elev. 1,058 ft., dry at 4,620 ft.

Baylor County: C. G. Hart 1 M. and L. Howe, Blk. 1, F. Cooper Sur. A-1009, 4½ mi. W. and 1 mi. N Round Timber, elev. 1,221 ft., dry at 1,902 ft.

Clay County: Pan Oil Co. 1 J. E. Moore, Sec. 21, Hopkins CSL A-176, 1½ mi. S Blue Grove, Chappel 6,141 ft., Ellenburger 6,151 ft., dry at 6,355 ft.

Cooke County: James T. Taylor 1 Rosson, G. W. Belcher Sur. A-187, 3 mi. S and 2 mi. E Myra, dry at 1,893 ft.

Bernard Voth & Sons 1 Voth, W. Middleton Sur. A-707, 2 mi. E Lindsey, dry at 1,865 ft.

Foard County: National Associated 1 Maggie Hammond, Sec. 41, Blk. 18, H&TC Sur., 2 mi. S Thalia, dry at 3,722 ft.

Jack County: Continental 1 J. E. Cox, Lot 32, Blk. 1, Henderson CSL, 1½ mi. N Gibtown, Barnett 5,722 ft., Ellenburger 6,030 ft., dry at 6,255 ft.

Montague County: Frank Parsons et al 1 S. E. Howard, Blk. 82, Kaufman CSL A-407, 4½ mi. S and 1 mi. E Spanish Fort, elev. 815 ft., dry at 3,049 ft.

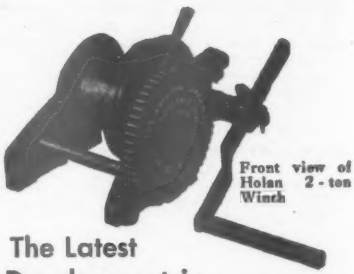
Throckmorton County: Consolidated Oil Co. and Premier Oil Co. 1 Edna F. Mitchell, Sec. 2132, TE&L Sur., 2 mi. N and 1 mi. W Elbert, Ellenburger 5,212 ft., dry at 5,280 ft.

Wichita County: Akin & Dimock 1-A Ray E. Gibson, Blk. 271, Waggoner CSL, 4 mi. N and 2 mi. E Electra, dry at 3,790 ft.

WEST CENTRAL TEXAS WILDCAT FAILURE

Coleman County: Hightower Oil & Refining Co. 1 W. N. Riley, J. S. Martin Sur., 2 mi. NE Rockwood, Caddo 1,469 ft., dry at 1,531 ft.

IT'S NEW — THE HOLAN 2-TON WINCH



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MISSISSIPPI

Two Wells Testing In New Fayette Field

JACKSON. — The new Fayette field in Jefferson County has two wells testing and two tests beginning this week. Humble Oil & Refining Co. 1 Hirsch Co., Inc., picked the Massive sand at 9,622 ft., and casing has been perforated at 9,655-58 ft. for the first tests. These perforations are about 20 ft. above the perforations producing in the discovery well, Humble 1 Smith. Humble B-1 Smith, 16-9n-1e, cored Massive sand with oil shows at 9,723-52 ft. and at 9,782-95 ft. Salt water was cored at 9,795-9,818 ft., and coring is continuing.

In the Gwinville field, Jeff Davis County, Humble B-1 Denkmann Lumber Co., 27-9n-19w, has been drilled and cored to total depth of 9,410 ft. Schlumberger indicates oil or gas shows in all sands from Eutaw, cut at 7,743 ft., to 9,245 ft. in basal Tuscaloosa.

MISSISSIPPI WILDCAT FAILURE

Washington County: Lisbon Gasoline 1 Wynn et al, 150 ft. south and 330 ft. west of NE corner of 22-17n-9w, dry. TD 5,186 ft., base chalk 3,872 ft.

ILLINOIS

New Fields May Be Opened In Three Counties

MATTOON. — Illinois had prospects of three new oil fields in as many counties during the past week, although no successful wildcats were completed. The first of these new prospects is in Clay County, where W. W. Shaffer 1 Wood, SE SW SE 21-5n-6e, has set casing on fair oil saturation found in the McClosky lime at 2,797-2,803 ft., total depth 2,804 ft. A 1-hour drill-stem test of this saturation recovered 250 ft. of clean oil, 90 ft. of oil-cut mud, and no water. The 1 Wood is 4 miles northeast of Iola and about 3 miles from other oil producers.

In Perry County, 5 miles north of Tamaroa, Texas Co. 1 J. S. Schwind, SW SW SW 5-4s-1w, are drilling plug with pipe set to test possible commercial oil saturation encountered in the Benoist sand at 1,306-16 ft. A 1-hour drill-stem test made immediately after the Benoist was drilled failed to show any free oil, but cuttings indicated a good show of oil. The well, about 3 miles from other production, was drilled to a total depth of 1,645 ft. and plugged back to 1,312 ft.

In the area 2 miles northeast of Cisne, Wayne County, Olson Drlg. Co. has set casing on the McClosky at their 1 Roush, NE SE NE 15-1n-7e. A 1-hour drill-stem test of the McClosky at 3,128-33 ft. got gas in 25 min., 120 ft. of clean oil, and 60 ft. of oil-cut mud.

Illinois had its best well in many months with the completion last week of Co-Op. Refining Co. 2 Rotramel, SW SE SW 7-2n-10e, in the Calhoun field of Richland County. During preliminary tests, the 2 Rotramel flowed 798 bbl. of oil in 6 hours and 15 minutes before being shut in. A ½-in. choke was placed on the flow line and the well flowed 1,620 bbl. of oil in 24 hours on initial tests. It is producing from the McClosky at 3,113-25 ft. after a 5,000-gal. acid treatment. Total depth is 3,127 ft.

ILLINOIS WILDCAT FAILURES

Jefferson County: Texas Co. 1 F. Boldt, NE NE SE 20-2s-1e, dry at 2,251 ft., Glen Dean 1,529 ft., Cypress sand 1,776 ft., Weiler 1,815 ft., Paint Creek 1,888 ft., Benoist 1,906 ft., Benoist sand 1,909-65 ft., Aux Vases sand 1,995-2,064

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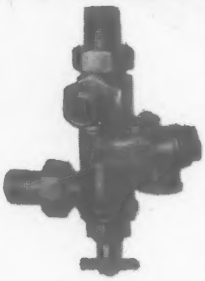

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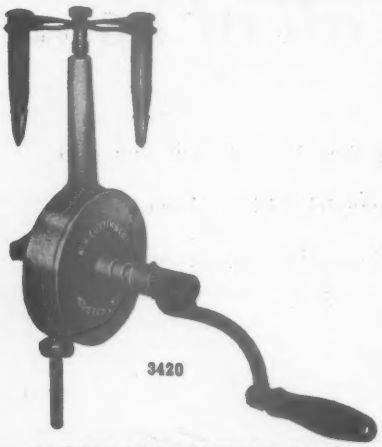

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ft., St. Genevieve 2,081 ft., Resiclare 2,124 ft., McClosky 2,176 ft., St. Louis 2,220 ft.

Richland County: R. E. Johnston 1 W. A. Treece, NW NW SE 10-2n-14w, dry at 3,188 ft., Menard 2,260 ft., Vienna 2,381 ft., Glen Dean 2,524 ft., Barlow 2,720 ft., Paint Creek 2,872 ft., Renault 2,946 ft., St. Genevieve 3,051 ft., McClosky 3.098 ft., St. Louis 3,178 ft.

Wabash County: Oliver Leighty 1 C. Schrader, NW SW SE 31-2n-2w, dry at 1,660 ft., Waltersburg sand 1,640-60 ft.

LA.-ARK.

Bossier Parish Test Flows From Nacatoch

SHREVEPORT.—Charles C. Lowery and Del Cryer 1 Levy, wildcat in Section 7-19n-11w, about 2 miles west of the Bellevue field in Bossier Parish, flowed oil into pits while drilling through the Nacatoch sand at 655-85 ft. Drilling is continuing below 1,130 ft.

In Caddo Parish, J. R. Querbes, trustee, et al 1 Mitchell estate, NW NW 8-18n-16w, in the Longwood area, perforated at 5,899-5,906 ft. in the Moneyham sand. The well started flowing oil and then started making gas and condensate. Operators will reperforate.

ARKANSAS WILDCAT FAILURES

Ouachita County: Skelly 1 Adams, NW NW NW 29-13s-18w, dry, TD 4,010 ft.

Union County: R. C. Wallingsford 1 Citizens Bank, NW SE NW 13-18s-13w, dry, TD 2,578 ft.

R. C. Wallingsford 1 Duke, SW NE NW 13-18s-13w, dry, TD 2,328 ft.

R. C. Wallingsford 1 U.S.M., SE NW NW 13-18s-13w, dry, TD 2,378 ft.

Arrow Drilling A-1 U.S.M., SW SW NE 8-18s-12w, dry, TD 2,412 ft.

NORTH LOUISIANA WILDCAT FAILURES

Caldwell Parish: J. F. Magale 1 Keelogg Brothers, 660 ft. north and east of Section 40 in Section 43-13n-4e, dry, TD 6,345 ft.

Richland County: American Liberty Oil 5 Mengel, SE SE SE 19-17n-8e, dry, TD 3,343 ft.

CALIFORNIA

Elk Hills Naval Reserve Test Has Large Flow

LOS ANGELES.—Present indications point to the probability that Navy Department will find the Hillcrest or western section of the Elk Hills Naval Reserve highly productive as Navy's 42-29-R in Section 29-30s-23e, showed up excellent on a formation test at 5,340-5,530 ft. several days ago. This well, located far west of nearest production, flowed at a daily rate of 1,000 bbl. of clean oil and is the most promising well in the area to date. One mile east of this well, Navy's 42-28-R in Section 28-30s-23e, came in as a gas well some time ago from 2,140 ft. Actual drilling of 42-29-R is being done by Brown Drilling Co. under supervision of Standard Oil Co. and Navy personnel. The importance of this potential producer is indicated by the fact that Navy this week abandoned its well 46-27-R in Section 27-30s-23e as a duster at 4,575 ft. This latter well is located between the older productive area at Elk Hills and the probable new Hillcrest completion, 42-29-R, and suggests the existence of a separate accumulation in the Hillcrest area. The present exploration work under way in the Hillcrest section of Elk Hills is for the purpose of determining how much of reserve exists at Elk Hills and will not be produced except for completion data. Navy's 42-29-R tends to indicate the existence of a major accumulation.

Richfield Oil Corp., despite two squeeze jobs, has been unable to exclude water in its probable discovery well in the Bandini district of Los Angeles Basin and has resumed drilling operations. The source of this water in Richfield's Union Pacific is still a mystery but the inability to put away any cement indicates it is possibly formation water. On a formation test a few days ago this well

(Continued on page 124)

ROCKY MOUNTAIN

Fishing Operations Delay Oregon Basin Wildcat

DENVER.—Although the discovery of oil in the Cambrian formation in the Oregon Basin field in Pacific Western Oil Corp. 5 Connaghan, SW SW SE 29-51n-100w, Park County, Wyoming, has not yet been proven a commercial well, it continues to be the most absorbing development in the Rocky Mountain area. Many operators consider it the most far-reaching discovery since the bringing in of the Salt Creek field, while a few conservatives want to see the oil in the tanks before giving way to their optimism. When coring began at around 6,350 ft., and recoveries showed light green oil saturation, the samples from 5,900 ft. down to that point were rechecked. This disclosed that the top of the saturated

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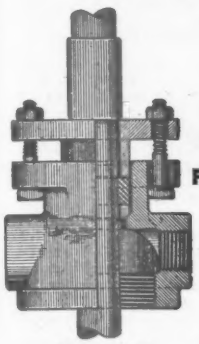

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sand was at approximately 5,950 ft., and saturation continued in sections where there was favorable conditions and good porosity down to the depth at which coring began. This added about 400 ft. to the possibly productive horizon in excess of what at first had been counted upon. These findings checked favorably with electric survey of the hole. The 5½-in. was cemented on top of the granite at 6,433 ft. The plan decided upon was to perforate in not more than 8-ft. intervals from the bottom upward to locate the water line, and if water was encountered, to run squeeze jobs and continue to back up the hole. The first perforations consisted of 15 holes at 6,343-47 ft., where water was expected. The water came in with such force that it overtook the perforating gun, which was being withdrawn from the hole, and pushed it up the casing, bridging the hole with the gun, supporting rope and the tangled wires. The result is a fishing job which will have to be cleared before further testing can be encountered. The operator has given the name "Kirk" sand to the main saturated horizon.

Deep test for Iles.—A unit plan for the operation of the Iles oil field in Mof-

(Continued on page 124)

OHIO, KENTUCKY

Sandyville Field Gets Three-Mile Extension

COLUMBUS.—A 3-mile extension to the Canton pool of the Sandyville field was found by Republic Steel Corp. 1 Fee, Sec. 2, Canton Township, Stark County. Red and white Clinton sands at 4,626-96 ft. made 1,552,000 cu. ft. Closer in toward gas production, East Ohio Gas Co. 1 Lucco Consolidation, Sec. 29, Plain Township, Stark County, gaged 1,245,000 cu. ft. Both wells were shot without increasing the open flow.

Another good well was added to the North Wellington pool in Lorain County by Ohio Fuel Gas Co. 1 Zeigler-Mills, Lot 19, Wellington Township. Clinton at 2,278-2,286 ft. gaged 3,220,000 cu. ft. natural. South and east offsets have been approved.

In western Newton Township, Muskingum County, Ohio Fuel 1 W. S. Powell, Sec. 11, gaged 944,000 cu. ft. Clinton sand was logged at 3,221-69 ft.

Indusutrial Gas Corp. 1 H. C. Smith, Sec. 12, is drilling in a mile extension to the Brush Creek field with 1,000,000 cu. ft. in the top of the Clinton.

Only six locations were reported for the week with Cambridge having three. Fifteen wells were completed, with Ashland and Lancaster sharing the lead with four each.

OHIO SUCCESSFUL WILDCATS

Stark County, Canton Township: Republic Steel 1 Fee, Sec. 2, Clinton, 4,607-96 ft., 1,600,000 cu. ft. gas, TD 4,698 ft.

OHIO WILDCAT FAILURES

Lorain County, Huntington Township: Ohio Fuel 1 Mike Moskel, Lot 18, Clinton, no sand, TD 2,555 ft.

WESTERN KENTUCKY

OWENSBORO.—Union County has prospects of a new pool in the area 1 mile southwest of Robinsonville, where Joe Engberg 1 Blake Bros., 22-P-20, is drilling plug to start testing good oil saturation encountered in the McClosky at 2,576-79 ft., total depth 2,579 ft. A 1-hour drill-stem test of this saturation recovered 120 ft. of clean oil and 102 ft. of oil-cut mud with no water. Casing has been set at 2,573 ft. The 1 Blake Bros. is about 1 mile from other oil wells.

Henderson County's prospective pool opener, Basin Drlg. Co. 1 Kasey Club,

(Continued on page 128)

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For fifteen years Tube Borium has been used on drilling bits to increase cutting speeds and drill more out-to-gauge hole. Now you can use this same alloy to greatly prolong the life of your tool joints!

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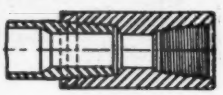

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OKLAHOMA

West Moore "Dry Hole" Makes 300-Bbl. Well

SOHIO PETROLEUM CO. has a new Bartlesville sand well at its 1 Garlinghouse, NE NW NW 33-10n-3w, with production estimated at 300 bbl. daily. The 1 Garlinghouse, east of the West Moore pool of Cleveland County, is now shut in for bottom-hole tests. The hole was redrilled to 8,300 ft. by Sohio who took over the Margay Oil Co. Wilcox failure at old total depth of 8,931 ft. The new operators drilled out and plugged back to 7,930 ft.; casing was set at 7,867 ft. and cement drilled out to 7,930 ft. The well started flowing immediately and flowed 40 bbl. of oil in 7 hours through 11/16-in. choke before being shut in for tanks. Gas-oil ratio was 1,000 to 1.

Sohio 1 Tolbert, NE NW NE 9-3n-1w, Garvin County pool opener northeast of Antioch, continued testing during the past week and showed prospects of making a gas-distillate discovery. After initial flow test of the Simpson sand at 4,547-49 ft., the well was killed with water. When the crew started swabbing down, it kicked off and flowed at the rate of 6 bbl. of fluid an hour through ¼-in. choke with gas estimated at 4,000,000 to 6,000,000 cu. ft. The fluid consisted of light-colored distillate, fresh water and mud with no salt water.

Casing has been set to test shows in the Skelly Oil Co. 1 Williams, SE SW NE 16-1s-4w, Stephens County prospect between the Velma and Scholem Alechem fields. After a sand in the Dornick Hills series was topped at 5,423 ft., a drill-stem test was taken at 5,429-70 ft. with resulting recovery of 20 ft. of oil and 60 ft. of oil-cut mud. The well was drilled on to 7,158 ft. where drilling was stopped to set 7-in. casing at 5,416 ft.

J. E. Trigg appears to have opened a new producing area at his 1 LeGrande, NE NE SW 26-15n-1w, Logan County wildcat northeast of the Arcadia field. The 1 LeGrande was abandoned in the Wilcox sand about a year ago by The Texas Co. after they failed to find a show at a total depth of 5,864 ft. The present operator went into the hole, cleaned out and plugged back to 5,223 ft. where a reported show of 15,000,000 cu. ft. of wet gas was obtained. Seven-inch casing was set at 5,207 ft. and testing will be resumed. Production is from the Bartlesville sand.

OKLAHOMA SUCCESSFUL WILDCATS

Oklahoma County: New oil pool—Harper-Turner 1 Johnson, SE NW 29-14n-2w, flowed 47 bbl. from Bartlesville at 5,894-5,910 ft., TD 5,917 ft., Oswego 5,620 ft., Bartlesville 5,890 ft.

Harper-Turner 1 Bailey, SE NW 28-14n-2w, flowed 3 bbl. and 1,250,000 cu. ft. gas from Bartlesville at 5,847-50 ft., TD 6,182 ft., Bartlesville 5,845 ft., Hunton 5,907 ft., Sylvan 6,027 ft., Viola 6,126 ft.

OKLAHOMA WILDCAT FAILURES

Carter County: Samedan and Sinclair 1 Croom, NW NE SE 20-4s-1e, dry, TD 5,255 ft.

Kingfisher County: Sunray et al 1 Stephens, NE NE SW 26-17n-5w, dry, TD 7,564 ft., Sylvan 7,182 ft.

Noble County: Renco et al 1 Ryerson, NW NE NW 31-20n-1w, dry, TD 5,190 ft., second Wilcox 5,163 ft.

Osage County: Cities Service No. 501, SE NW 2-24n-8e, dry, TD 2,475 ft., May 2,435 ft.

Pawnee County: J. R. Porter et al 1 Gilliland, NE NE NE 29-23n-4e, dry, TD 3,983 ft., Wilcox 3,973 ft.

Stephens County: W. R. Gamble 1-A Harley, SE NW SE 19-2s-6w, dry, TD 1,756 ft.

Jones & Hamner et al 1 Willis, NE SW SE 5-1s-8w, dry, TD 2,539 ft., in sand.

KANSAS

South Ryan Discovery Gets 143-Bbl. Potential

HILDBRANDE ET AL 1 Wickstrom, NW NW NW 12-20-16w, discovery well in the new South Ryan pool, has been assigned a daily potential of 143 bbl. Lansing was topped at 3,420 ft., and Arbuckle at 3,688 ft. Perforations at 3,739-48 ft. yielded 51½ bbl. of oil per hour, and after a treatment with 1,000 gal. acid, the well flowed 25 bbl. of oil per hour. The new pool is between Pawnee Rock pool and the Ryan pool. Two offsets to this well are now in progress, both being drilled by Magnolia Petroleum Co.

In Cowley County, W. L. Hartman and B. B. Blair 1 Smith, SE SE SW 15-33-3e, a wildcat about 1 mile east of Rainbow Bend pool, swabbed 2½ bbl. of oil per hour natural. Bartlesville was cut at 3,223 ft., and the well drilled to total depth 3,266 ft.

Completions for the week totaled 41, including 23 oil wells, 6 gas wells and 12 dry holes, 3 of which were wildcats. Kraft-Prusa field led with four oil completions, and the Hugoton field added five gas wells.

Forty-one new locations were announced this week, including nine wildcats. New wildcat starts are spotted, two in Morris

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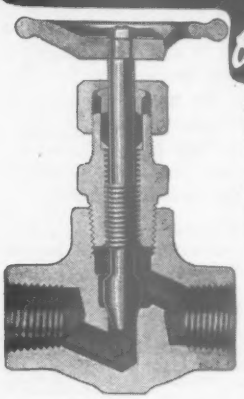

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DIMENSIONS AND RATINGS

SIZE	⅛"	¼"	⅜"	½"
End to End—Globe	1⅞	1⅞	2¼	2¾
Center to end—Angle	15/16	15/16	1⅛	1⅜
Center to top—Open	3⅝	3⅝	3⅞	4
Port diameter	⅛	3/16	¼	⅜
Weight—lb	1	1	1¼	1½

4000 lb AT 150 F
600 lb AT 750 F
475 lb AT 1000 F

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With stem at 60 degrees to the flow line, these versatile and economical valves, approximate straightway flow. Tough EValloy stainless steel seats, disks and stems fight erosion and corrosion in the vital areas of greatest wear. Same design available in angle construction.

FIG. 2698 Globe stop valve Sizes ¼ in. to 2 in. Inside screw Screwed and socket welding ends In angle design—Fig. 2699

ASA Working pressures 600 lb at 850 F Steam, oil or gas Hydraulic (non-shock) 1400 lb at 100 F

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Edward Valves
Forged Steel & Cast Steel

County, and one each in Butler, Ellis, Marion, Russell, Stafford, and Woodson counties.

KANSAS WILDCAT FAILURES

Greenwood County: R. P. Johnson et al 1 Johnson, SW SW 18-26-13e, dry, TD 1,740 ft., Mississippi lime 1,695 ft.

Russell County: Gough Davis et al 1 Krug, NE NE NE 3-13-14w, dry, TD 3,155 ft., Arbuckle 3,141 ft.

Stafford County: Willis Hartman et al 1 Anschultz, SE SE NW 11-21-14w, dry, TD 3,750 ft., Arbuckle 3,694 ft.

CANADIAN FIELDS

Turner Valley Outposts Nearing Madison Lime

CHATHAM, Ont.—Two outpost wells in the Turner Valley northwest extension are nearing the decisive stage and, if successful, will materially extend the producing area. Home Oil 20, LSD 7, 24-21-4w5, is below 9,000 ft. after entering Kootenay formation at 8,940 ft. and is believed near the Madison limestone. Home 21, LSD 11, same section, ¼ mile north and west, is in upper Blairmore at 8,745 ft.

Brazeau.—On the Brazeau structure, in the Central Alberta foothills, Home-Brazeau 1, LSD 5, 17-43-17w5, is in lower Blairmore below 10,128 ft. and again nearing the Madison, from which it faulted at 9,597 ft. With formations recurring in normal sequence, prospects for the well, testing a large formation similar to Turner Valley, are much improved.

Jumping Pound.—On the Jumping Pound structure, west of Calgary, Shell 10-14-J, LSD 10, 14-25-5w5, total depth 10,959 ft., which struck salt water in the porous horizon of the Madison, has placed bottom plug and is being temporarily abandoned.

Steveville.—In the Steveville-Princess field, eastern Alberta, Princess - C.P.R. 76-23-A, LSD 12, 23-30-12w4, total depth 3,984 ft., is being finished as a gasser. One other well is testing and two are drilling.

Saskatchewan.—Since April, when production started, to the end of October, Saskatchewan wells in the Lloydminster field have produced 11,144 bbl. Three wells are now in production, the largest making around 40 bbl. daily, and two others are being put on the pump.

Tar sands.—The Alberta Government's experimental pilot plant at Bitumont, in the oil sands area north of McMurray, is expected to make its first test runs for separation of oil from the sands late next fall. Oil Sands, Ltd., operating the plant under agreement with the province, is preparing to move necessary materials to location.

Gaspe.—In the Gaspe peninsula of Quebec, Peninsular Oil Corp. has commenced drilling near the town of Gaspe. Extensive surveys have also been made by Gaspe Oil Ventures, and is building roads to move in drilling equipment. The field was the scene of extensive drilling some 50 years ago, but though numerous oil showings and some near-commercial flows were encountered, tests were not carried deep enough to give conclusive results. The present drilling is planned for a thorough test of the limestone, and production is expected a little below 4,000 ft.

Ontario.—In the Ontario fields, Union-Imperial 1, a joint test of the Trenton limestone by Union Gas Co. and Imperial Oil, located in Lot 1, Concession 4, Chatham Township has finished in pre-Cambrian at 3,680 ft. Only slight traces of oil were encountered.

APPALACHIAN FIELD

Beaver County Wildcat To Test Oriskany Sand

PITTSBURGH.—In South Beaver Township, Beaver County, Pennsylvania, the Beaver Hill Oil & Gas Co. has the rig standing for an Oriskany test on the C. C. Kennedy farm. It is approximately 2 miles due east of the former Oriskany gas well on the Tennis farm, now exhausted, and about 1½ miles due south of the Oriskany test on the Beaver County Airport on the Black Hawk Road which found salt water in the Oriskany. The Oriskany pool to the west produced a lot of gas before depletion.

In North Strabane Township, Washington County, the 2 Hugh and Grant Boyles completed by Ed Beedle et al is being swabbed for shot and is making about 40 bbl. a day from the Gordon sand.

New locations for the week totaled four and were scattered in Bethel and Kiskiminitas Townships, Armstrong County; Cumberland Township, Greene County and Washington Township, Indiana County.

In the Ravenswood district, Jackson County, West Virginia, the test of United Carbon Co. 1,320 W. E. Hupp topped the Oriskany sand at 4,786 ft., and at 4,804-08 ft. there was an open flow of 9,500,000 cu. ft. gas which, after being shut in, tested 8,572,000 cu. ft. with a rock pressure of 1,360 lb. in 23 hours. Drilling was halted at 4,808 ft.

In Portland district, Preston County, Wm. E. Snee et al recovered lost bailer and cable at 6,180 ft. and drilled ahead to 6,189 ft. At 6,185 ft. there was a pocket of gas and at 6,189 ft. there was a second

(Continued on page 128)

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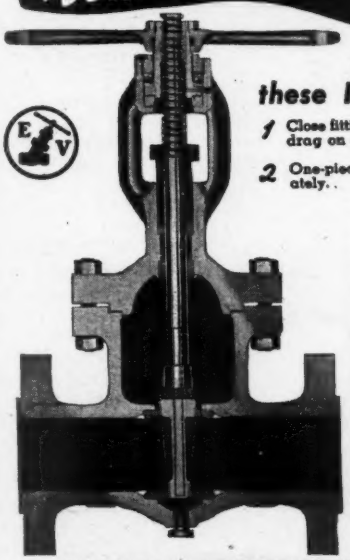

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Among the Drilling Contractors

Regent Drilling Co. of Vermilion, Alberta, recently spudded Martin 2, LSD 12, 9-42-6w4 on the Vale Dome near Wainwright, Alberta, for the Irwin Millner interests of New York.

General Petroleums of Calgary is handling the contract for P. S. & D. 1, LSD 2, 3-20-12w4, a joint test by Princess Petroleums, Globe Oils and P. S. & D. Oils in the Steveville-Princess field, eastern Alberta. The test is now drilling.

Brown Geophysical Co. crews left recently for Oklahoma after completing a survey contract for Shell Oil Co. of Canada in a number of Alberta plains areas.

D. & G. Oil Field Specialists has been formed with offices in 13 Board of Trade Bldg., Calgary, to supply laboratory service, including analyses of various types, for the oil industry in Alberta.

General Petroleums of Calgary are drilling below 4,200 ft. on the first of a series of offset tests for Continental Oil Co. of Canada, Ltd., in Turner Valley. A series of 13 wells offsetting Turner Valley producers is planned.

Delta Drilling Co., Evansville, Ind., will drill Iley B. Browning 1 Groves, 12-N-23, in Webster County, Kentucky.

C. E. Brehm is the contractor for Nu-Enamel Corp. 1 Miller, NW NE SE 20-6n-10e, in Jasper County, Illinois.

Fisher Drilling Co. is moving in material for John C. Robbins, Jr., 2 Finley, 330 ft. south and east of NW cor. SW 18-9n-8w, in the Eucutta field of Wayne County, Mississippi.

George & Wrather, Mount Carmel, Ill., is the contractor for two tests in Gibson County, Indiana. They are Grace Hulman 2 Deep Vein, NW SE NE 27-1s-12w, and Grace Hulman et al 1 Preston Milburn heirs, NW SE SE 29-1s-11w.

N. V. Duncan, Fairfield, Ill., is the contractor for two Illinois tests, Walter Duncan 4 Macke, NW SE NW 23-12n-7e, Coles County, Illinois, and Pure Oil Co. 1 Ritz, 180 ft. north of C W½ SW SE 9-6n-10e, in Jasper County, Illinois.

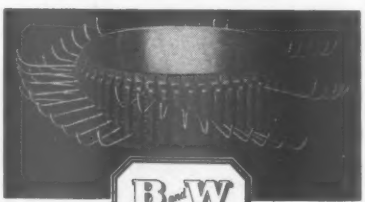
Big Chief Drilling Co. has the contract for L. A. Chudacoff 1 Tabor, NE SW SE 11-11n-16e, McIntosh County, Oklahoma.

Brown & Eakle, Carmi, Ill., has the contract for Phillips Petroleum Co. 6 Laura, SW SW SW 18-4s-11e, in White County, Illinois.

Dow Chemical Co. will drill 1 Schreiber, NW SE SE 2-13n-2e, a wildcat in Midland County, Michigan.

Good Progress Reported on Drill-Stem Study

DALLAS.—The American Association of Oilwell Drilling Contractors reports that good progress has been made in the collection of data that will be used by Battelle Memorial Institute in its study of drill-stem performance. H. M. Banta, Battelle's engineer assigned to this work, recently spent 5 weeks in the Permian Basin gathering material. He subsequently visited



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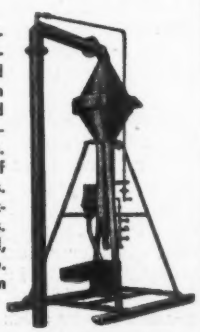

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Houston to observe certain phases of fatigue-testing practices, after which he returned to headquarters in Columbus. He later visited mills manufacturing drill pipe, studying contractors' problems and their relationship to mill practice.

A progress report is now being prepared by Battelle which will shortly be presented to the association. The report will cover various phases of the investigation up to date.

It is felt by members of the research committee of the association that the program will ultimately be expanded to include research into other phases of drilling operations, but during the first year only factors affecting the performance of the drill will be considered, including mud.

CALENDAR

1946

January

SAE, annual meeting, Book-Cadillac Hotel, Detroit, January 7-11.

FPC regional hearing in natural-gas investigation, Court House Building, Houston, January 28.

Independent Natural Gas Association of America, annual membership meeting, Texas State Hotel, Houston, January 28.

February

American Welding Society, national meeting, Hotel Cleveland, Cleveland, February 4-7.

Iron and Steel and Institute of Metals divisions, American Institute of Mining and Metallurgical Engineers, national meeting, Statler Hotel, Cleveland, February 4-8.

American Society for Metals, annual convention (postponed from 1945), Statler Hotel, Cleveland, February 4-8.

FPC regional hearing in natural-gas investigation, Buena Vista Hotel, Biloxi, Miss., February 11.

FPC regional hearing in natural-gas investigation, Chicago, February 19.

American Society for Testing Materials, spring meeting, Pittsburgh, February 25-March 1.

Exposition of Chemical Industries, twentieth exposition, Grand Central Palace, New York, February 25-March 2.

March

FPC regional hearing in natural-gas investigation, Charleston, W. Va., March 19.

Southern Gas Association, annual convention, Galveston, March 21-22.

April

American Association of Petroleum Geologists, annual meeting, Stevens Hotel, Chicago, April 2-4.

Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas, April 17-19.

National Petroleum Association, semi-annual meeting, Hotel Cleveland, Cleveland, Ohio, April 18-19.

May

National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City, Mo., May 7-9.

June

American Society for Testing Materials, annual meeting, Buffalo, June 24-28.

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By placing the Baker Rotary Casing Scraper above the bit,

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when you drill out cement, it will remove the sheath

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of hardened cement, also any scale, and dangerous

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burrs left from gun perforating. This leaves your casing clean, smooth, and safe so it cannot damage rubbers, packers or swabs, or interfere with future "down-the-hole" operations. No serviceman required. Reasonable rental basis.

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Wear longer than any other tong before repair. Cost less to repair. It will pay you to investigate.

See Composite Catalog Pages 3101 to 3120.

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PERSONALS

Ordnance Plant Record Leads To Promotion

LOUIS D. MANN, builder and operator of the Maumelle Ordnance Works at Little Rock, Ark., five-time winner of the Army-Navy E during the war, last week was appointed vice president and general manager of Cities Service Refining Corp., at Lake Charles, La.

Louis Mann has been 28 years with Cities Service, having started as a chemist in 1917 after his graduation from Union College in Schenectady, N. Y. He came up through the refinery ranks and before the war was assistant general superintendent of all refineries operated by Cities Service Oil Co. (Del.).

When, at the urgent request of the government, Cities Service undertook the construction and operation of the Maumelle Ordnance Works, Mann was picked to run it. Manufacturing a critical high explosive, the vast, sprawling plant was one of the most secret operations of the war.

William W. Lowe, former general manager of the Lake Charles refinery, will return to New York where he will join the staff of Petroleum Advisers, Inc., the management and technical group coordinating Cities Service petroleum and natural-gas operations.

G. L. Mateer, former general superintendent at Lake Charles, will also move to New York as technical director of manufacturing operations in the Petroleum Advisers group.

Henry Waters, Tulsa, vice president of Stanolind Oil Purchasing Co., has been assigned the additional duties of secretary to the corporation. **A. L. Carlson,** formerly secretary and treasurer, has resigned and **P. J. Ryan** has been promoted to treasurer.

Cary P. Butcher, Midland, West Texas district manager for Richfield Oil Corp., has resigned and will engage in independent producing operations and geological consultation work.

Jack T. Perkins, district representative of Sohio Petroleum Co., in Tulsa, will take charge of the company's new crude-oil purchasing office for Texas, in the Continental Building, Dallas, January 1.

M. L. Mayfield, Houston, formerly technical adviser to the District 3 natural-gas and natural-gasoline industry committee, has entered the consultation field. Before the war he served as chief petroleum engineer for Cotton Valley Operators Committee and was on the production engineering staff of Cities Service Oil Co.

W. U. Jones, Overton, has been elected chairman of the East Texas chapter, American Petroleum Institute. **L. A. Gillis,** Tyler, and **L. H. Dial** and **H. D. Greensides,** Kilgore, are vice chairmen.

E. H. Eddleman, Fort Worth, formerly manager of Fleming Oil Co., heads a group of Texas oil men organizing the Oil States Supply Co. which will conduct a general oil-equipment business in North and West Texas. **I. Dee Campbell,** former membership director for the Independent Petroleum Association of America, is vice president of the new firm and **W. A. Moncrief,** Fort Worth producer, is treasurer.

Paul R. Martin, Midland, Pure Oil Co., has been elected president of the Permian Basin Oil Scouts Association. **Lee Conroe,** Globe Oil & Refining Co., is first vice president; **W. G. Ross,** Sinclair Prairie Oil Co., is second vice president, and **Frank Wood,** Atlantic Refining Co., is secretary-treasurer.

E. C. Saxe has been promoted by Shell Oil Co., Inc., from foreman of the construction and maintenance division at Ventura, Calif., to production foreman. His former position has been taken by **Ben Dorman,** who was head roustabout.

J. H. Sembower, Houston, released from the Navy after serving 3 years during the war, has been appointed manager of the personnel and industrial relations department of Shell Oil Co., Inc.'s Gulf Coast area. Before entering military service, he had been employed by Shell 8 years.

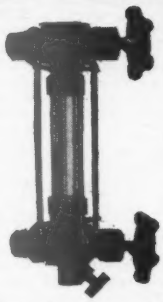
Lt. Col. Robert H. Ingalls, C. E., formerly chief, Supply Division, North Atlantic Division, Corps of Engineers, has rejoined the purchasing department of Standard Oil Co. of New Jersey, with which he was associated for 13 years prior to his military service. During his organization and operation of the military purchasing department, Colonel Ingalls placed under contract the largest number of military items handled by any office of the corps, amounting to more than $700,000,000.

George J. Woods, who was manager of Continental Oil Co.'s Chicago division, has been transferred to Ponca City, Okla., to succeed **P. J. Ryan** as manager of sales operations when Ryan retires next June. **J. L. Wait,** formerly assistant division manager at Chicago, succeeds Woods. **J. W. Liddell,** who was manager of railway sales in Chicago, has been appointed northern sales manager in Chicago, with supervision over the Chicago, Kansas City, and Lincoln divisions. **E. F. Shannon,** formerly assistant manager of railway sales, succeeds Liddell. **W. F. Hird,** formerly division manager at Lincoln, was appointed manager of the Ponca City division, succeeding **J. G. Davis,** now commission repre-

PENBERTHY

"ALL IRON"

LIQUID LEVEL GAGES



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The "All Iron" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

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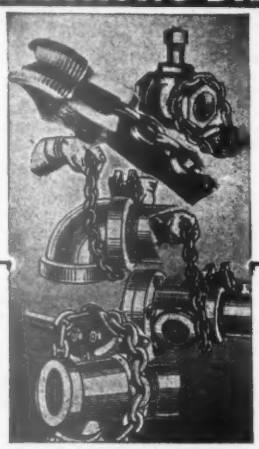

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Eastern Warehouse & Sales: 199 Lafayette St., New York

sentative at Tulsa. **W. R. Fitzpatrick,** formerly assistant division manager at Lincoln, succeeds Hird. **W. B. Elliott,** who was division manager at Denver, has been shifted to a similar post at Albuquerque, succeeding **J. P. Anthony,** now commission representative at Colorado Springs. **P. M. Hirth,** formerly manager of the Salt Lake City division, was oppointed to a simlar position at Denver. **L. R. Kump,** formerly assistant division manager at Salt Lake City, succeeds Hirth.

Roy A. Riddle has been transferred to the New York office of Standard Oil Co., (N.J.), as assistant head of the construction and maintenance department, from Charlotte, N. C.

Dr. Karl Cohen, a graduate of Columbia University in physical chemistry, has been appointed to head a new theoretical physics group by the Standard Oil Development Co. Among other duties, this group will investigate the possibilities for applying atomic energy to industrial uses. Activities will be centered in the new laboratory to be constructed at Linden, N. J.

Arthur M. Dodge is returning to Socony-Vacuum Oil Co., after having served throughout the war in the Coast Guard. He will do liaison work with the inland fleet and **Edward S. Bischoff,** who served for some time as a ship's officer, will act as contact man between the deep sea fleet and the newly established industrial relations section in the Marine Operating Division.

E. J. Schwanhausser, vice president, Worthington Pump & Machinery Corp., was elected president of the Diesel Engine Manufacturers Association at the association's annual meeting in Chicago December 11. **Gordon Lefebvre,** president of Cooper-Bessemer Corp., and **J. E. Peterson,** vice president of General Machinery Corp., were elected vice presidents.

W. G. McAndrew has been promoted to superintendent of the paraffine and lubricating division of Standard Oil Co. of New Jersey's Baton Rouge, La., refinery. He succeeds **W. D. Farr** who retired after serving the refinery more than 38 years.

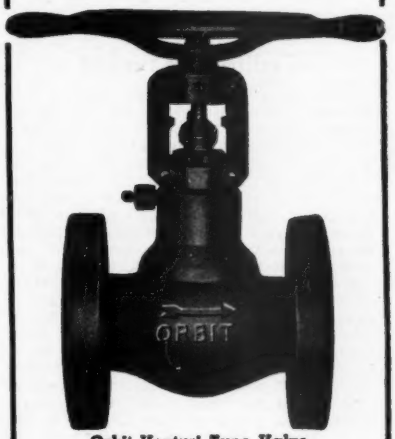
H. O. Harder, Oklahoma City, has been moved to Tulsa and appointed assistant general superintendent, production department, Sunray Oil Co.

H. A. Birdwell, district superintendent for Sunray Oil Co., has been transferred from Big Spring to Odessa, Tex., and placed in charge of the latter producing area. **M. E. Perry** succeeds Birdwell as superintendent in the Big Spring district.

ORBIT VALVES

FRICTION FREE

The Orbit Venturi Type Valve not only prevents turbulence thus prolonging the life of your tree . . . But with its hardfaced seats coupled with other revolutionary operating principles combine to give the user ease of operation at 3000 to 5000 lbs. W. P. that is attainable in conventional valves at static pressure only.



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ORBIT VALVES REQUIRE NO LUBRICATION TO EFFECT A SEAL.

See Pages 2194 to 2211 in 1944 Composite Catalog

ORBIT VALVE COMPANY

TULSA, OKLAHOMA

SUMMARY OF NOVEMBER COMPLETIONS*

	Comp.	Oil	Prod.	Gas	Dry	Under 1,000 ft.	1,000-2,500 ft.	2,500-5,000 ft.	5,000-10,000 ft.	Over 10,000 ft.	Total footage	Rigs and drilling
New York	118	59	97	0	†59	0	118	0	0	0	176,877	136
Pennsylvania	314	159	173	17	‡138	35	252	27	0	0	545,562	342
West Virginia	59	9	86	34	16	0	21	35	3	0	155,909	71
Ohio	96	18	396	42	36	9	30	54	3	0	254,932	181
Indiana	17	9	551	0	8	0	14	3	0	0	32,671	47
Kentucky	79	51	6,336	9	19	11	43	25	0	0	155,740	79
Illinois	168	99	15,089	0	69	3	69	96	0	0	424,037	221
Michigan	63	21	15,863	7	35	1	32	30	0	0	149,248	161
Kansas	153	68	32,771	26	§59	0	16	136	1	0	500,435	324
Neb., Mo., Iowa	9	0	0	1	8	4	4	1	0	0	14,239	11
Oklahoma	220	128	20,563	23	¶69	14	36	119	50	1	834,538	539
Texas	572	284	75,118	80	208	28	98	190	231	25	2,661,928	1,223
North	126	50	5,167	0	¶76	25	46	24	22	9	332,958	229
West Central	37	11	7,974	5	21	1	8	24	4	0	125,165	85
West	136	93	42,340	9	34	1	22	63	46	4	629,369	377
Panhandle	35	4	1,098	31	0	0	4	31	0	0	104,002	97
Eastern	49	20	5,115	22	7	0	2	14	33	0	294,004	133
Upper Gulf Coast	61	34	4,530	2	25	0	3	6	45	7	428,312	117
Lower Gulf Coast	89	55	7,817	8	26	0	0	13	71	5	602,052	131
South	30	15	797	2	13	0	10	13	7	0	108,717	28
South Central	9	2	280	1	6	1	3	2	3	0	37,349	26
Louisiana	115	66	14,055	7	42	4	7	39	42	23	752,475	236
Northern	65	38	7,715	7	20	4	7	36	18	0	287,774	123
Southern	50	28	6,340	0	22	0	0	3	24	23	464,701	113
Arkansas	11	7	1,821	0	4	0	2	4	5	0	50,457	55
Mississippi	29	16	3,612	0	13	0	1	5	18	5	195,883	56
Ala., Ga., Florida	6	2	195	0	4	0	0	5	1	0	26,308	15
Montana	29	20	1,200	5	4	0	15	14	0	0	68,659	89
Wyoming	24	16	2,863	3	5	0	1	18	5	0	102,567	88
Colorado	7	5	2,169	0	2	1	0	0	6	0	38,478	49
New Mexico	25	14	1,046	3	8	1	3	14	7	0	101,658	106
California	147	105	19,867	5	37	8	28	78	30	3	556,039	230
Total November	2,261	1,156	213,871	262	843	119	790	893	402	57	7,798,640	4,259
Total October	2,094	1,089	201,059	214	791	118	774	779	373	50	7,106,599	4,280

*Four weeks ending November 24, 1945. Service wells included: †59, ‡131, §4, ¶1.

California Fields

(Continued from page 116)

flowed at a daily rate of 750 bbl. of oil cutting between 30 and 40 per cent and 1,000,000 cu. ft. of natural gas. This is the best-looking wildcat in the state at the present time despite the water cut which may indicate an unfavorable location structurally. This wildcat has something that has been noticeably absent in several other wildcats, sufficient gas pressure and volume to kick over and sustain production. The water problem which may not be due to a mechanical failure will be surmounted either through corrective work or the selection of a new location. Richfield is rigging up a third Bandini test which will be drilled on the Vail property in Section 16-2s-12w.

Shell Oil Co. has been swabbing its deep test in the Long Beach field for the past several days and while some oil has been coming to the surface the amount has been small. Shell's deep test is 48-A Alamitos which has been carried down to the basement at 14,950 ft. and has 6⅝-in. casing cemented at 12,853 ft. Because of the depth of the hole it may be another several days before the status of this deep test will be determined. Fluid level was found at 3,500 ft.

New locations greatly exceeded completions this week due to Union Pacific's posting of 25 locations for the Wilmington field. Few of these projected wells will be started prior to 1946. There are enough additional locations available in the Wilmington field to permit an increase in drilling next year for this field but most other fields will probably show a decline. The outlook for 1946 is for a steady rate of development and a slight increase in wildcat exploration.

CALIFORNIA WILDCAT FAILURES

Kern County, San Emidio: Western Gulf 1 San Emidio, 34-11n-22w, bottomed in hard gray shale, only minor showings, TD 3,548 ft.

Los Angeles County, Los Angeles City: Seaboard 1 Brick Yard, 21-1s-13w, bottomed in hard gray sand, oil and small gas showings logged but no commercial production developed, TD 7,505 ft.

Solano County, Palmyra: Lebow & McNee 1 Peters, 7-5n-1e, bottomed in gray sand, low structurally, no showings, TD 5,594 ft.

Tulare County, Corcoran: E. C. von Glahn 1 Green Cattle, 33-21s-23e, bottomed in hard gray sand, no showings, top Miocene 5,585 ft., TD 5,692 ft.

Ventura County, Conejo: O. R. Sickler 1 Conejo, 4-1n-20w, bottomed in barren gray sand, shallow Conejo sand missing, TD 85 ft.

Rocky Mountain Area

(Continued from page 117)

fat County, Colorado, was approved by the Secretary of the Interior on November 23, and this action paves the way for the long anticipated deep test to the Weber, the producing horizon at Rangely, and other sands below that formation. Stanolind Oil & Gas Co. was named operator for the unit. That company, the Texas Co. and Kinney-Coastal Oil Co. are principal leaseholders. Approximately 3,400 acres are within the unit. Plan calls for a test to start within 6 months to go to at least 7,500 ft. or commercial production. The field has produced more than 11,000,000 bbl. from the Morrison and Sundance sands, the lowest horizons tested. The outcome of the test will have an important bearing on the Moffat oil field, Thornburg gas field, and other structures in Moffat County which never have been drilled below the Sundance. Approval of the unit was coincidental with extension of federal leases about due to expire.

Buckingham test dry.—Fred M. Manning, Inc. and George Dickey 1 Ashbaugh, C NE NE 15-7n-59w, Buckingham district, northeastern Colorado, was dry at 6,795 ft. It had 26 ft. of the Muddy sand, top at 6,709 ft. A drill-stem test at the bottom showed 250,000 cu. ft. of gas, some oil-cut mud and water. Top of the Dakota was at 6,791 ft. and hole filled with water. This was the third test around the Ramsey well which in 1932 made 6,000,000 cu. ft. of gas in the Muddy and swabbed 40 bbl. of oil in 24 hours from a thin streak of Dakota sand followed by water. The Ashbaugh well was ¾ mile northwest of the gas well.

Cat Creek lease sale.—A 40-acre state lease in SW SW 16-15-30, Cat Creek field, Petroleum County, Montana, brought $650.75 an acre at a lease sale, the purchaser being the Farmers Union Central Exchange, which operates a refinery at Laurel. It offsets on the north the Fifer tract upon which Schock brought in recently the discovery well in the Ellis sand, and on the east Continental Oil Co. tract upon which that company is now drilling. The 40 acres in NW SW Section 16 brought $150.75 an acre and the 120 acres in E½ SW and SW SE of 16 were bid in for $60.75 an acre. The four Ellis sand wells were still flowing natural at last reports, the discovery making 185; No. 2 Fifer, 55; 3 Fifer, 80, and 4 Fifer 224 bbl. per day.

New operations.—New operations were down to four for the week, the decline being credited principally to the slowing up of drilling operations in the area during the winter. These were distributed one in Colorado, two in Wyoming, and one in Montana.

Completions.—Nine wells were completed in the Rocky Mountain area, of which seven were oil wells with initial production of 2,320 bbl., and two were dry holes. One completion for 605 bbl. was in the Rangely field in Colorado. Five oil wells with initial of 1,640 bbl. were in Wyoming, one each in Big Muddy, Elk Basin, Little Buck Creek, Half Moon and Notches. Montana had one completion in Cut Bank for 75 bbl. The two dry holes were Colorado wildcats.

COLORADO WILDCAT FAILURES

Buckingham district, Weld County: Fred M. Manning, Inc. and George Dickey 1 Ashbaugh, NE NE 15-7n-59w, TD 6,795 ft., Muddy sand 6,709-35 ft., show of gas and oil-cut mud with water, water in Dakota, topped at 6,791 ft., dry.

Wiggings district: Tide Water Associated and Ohio Oil 1 Weld County-7, NW SW SW 1-3n-61w, dry at 6,991 ft., oil and gas-cut mud in hard Muddy sand at 6,407-27 ft., top of Dakota 6,469 ft., show oil and gas in top followed by water, top Lakota 6,773 ft., water, dry.

HELP WANTED

WANTED: Observers, engineers, shooters, and computors, for domestic seismograph work. Good future, permanent employment for those qualified. Box A-890, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Administrative assistant familiar with oil field drilling and production operations and materials and office procedures to assist in cooperative work. Graduate engineer preferred but not necessary. Give complete history of previous and present work and salaries received and expected, with references. All replies will be kept confidential. Address Box A-895, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Graduate Mechanical Engineer having at least 6 to 10 years refinery experience, design, maintenance and construction. Box A-901, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Expert cementer of oil and gas wells. Monthly salary plus expenses. Steady job for sober and dependable man. Standard Cementing & Mudding Co., 110 Federal Square Bldg., Grand Rapids 2, Michigan.

WANTED: By The Superior Oil Company young men with college background in electronics. Single men preferred. Write P. O Box 96, Bakersfield, California. Apply 1425 Union Ave., Bakersfield, California.

WANTED: By The Superior Oil Company, young men with college background in geology. Single men preferred. Write P. O. Box 96, Bakersfield, California. Apply 1425 Union Ave., Bakersfield, California.

INSTRUMENT ENGINEER technically trained to take charge of layout, installation, and maintenance of instruments in petroleum refinery. Chicago district. Box A-916, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Manager for construction division to take full charge. Executive with ability to organize and get results. Must be experienced with oil refineries, chemical, steel construction, etc. Write stating age, education, experience, references and salary expected. Box A-813, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: MINING OR PETROLEUM ENGINEER by Major Oil Company. Recent graduate or with some experience, for Exploitation and Production Engineering work. Training course if inexperienced. Write Box A-799, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: MECHANICAL ENGINEER. Major Oil Company requires graduate Mechanical Engineer for Production Department. Either experienced or inexperienced. Write Box A-800, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERS WANTED

An oil field Service organization has openings for engineers in technical oil field service. Men with one or two years experience in oil production and degree in Petroleum, Electrical or Mechanical Engineering are given preference. Permanent position with long established company. Write giving full details on education, experience, age and marital status. Attach small photograph. Address replies to Box A-870, The Oil and Gas Journal, Tulsa, Oklahoma.

LARGE MIDWEST MANUFACTURER

of mechanical and electrical equipment requires services of two petroleum industry men with rather intimate general knowledge of either refining or drilling and general knowledge of the other. Liaison work between manufacturing and sales departments to improve present petroleum equipment lines and stimulate development of new items. Give full details first letter. Write Box A-917, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

DRILLERS

Steady work, good wages, water wells year round, Bucyrus machines, essential to war effort, draft exempt. Apply — Gray Well Drilling Co., Inc., Box 181. Phone 1051, Delafield, Wisconsin.

FOREMAN of repair and maintenance shop. Must be qualified machinist and fully experienced on repair and maintenance of plant equipment in petroleum refinery preferred. Chicago district. Box A-915, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Experienced Core Drillers. Steady work and good wages. Bury & Clemens Exploration Co., Box 316, Princeton, Indiana.

WANTED

MECHANICAL ENGINEERS WITH EXPERIENCE IN DESIGN AND DEVELOPMENT OF OIL FIELD MACHINERY.

THE BREWSTER COMPANY, INC.
P. O. BOX 1095
SHREVEPORT, LOUISIANA

SITUATIONS WANTED

WANTED: SUPERVISORY OR ENGINEERING work in Construction or Maintenance Instrumentation. Background; Mechanical Engineer Graduate with seventeen years in Oil Refining Industry. Familiar with most all makes of instruments. O. S. Calhoon; Hinsdale, Illinois.

GEOLOGIST with 8 years experience in petroleum geology and paleontology domestic and foreign wants position as paleontologist for major oil company operating in South America or Far East. Salary $500 month and living quarters for family available. Box A-898, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE Electrical and Radio Engineer; age 38, with 17 years experience, desires position with oil or gas company. Box A-572, The Oil and Gas Journal, Tulsa, Oklahoma.

EX-NAVAL AVIATOR, age 27, University of Notre Dame graduate, licensed commercial pilot; desires position with person or corporation, preferably as pilot and executive assistant. Ambitious, reliable. Excellent references. South America considered. Box A-900, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED REFINERY construction and operator desires position in small progressive refinery with option to purchase interest. Box A-904, The Oil and Gas Journal, Tulsa, Oklahoma.

PURCHASING AGENT desires permanent position with major or well established independent company. Thoroughly experienced in purchasing organization, procedure, handling people, assuming responsibilities, and very familiar with machine tools. Age 29, University, and now employed as Purchasing Agent by large Industrial and Mill Supply Co. Available two weeks. Salary $350.00. Box A-906, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SUPERINTENDENT: Thirty years' experience in construction and operating skimming, cracking, polymerization units; also gasoline plants. Would like to make connection with independent company in southwest. Can furnish best of references. Available January 1st. Box A-914, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES REPRESENTATIVE: Graduate Electrical - Mechanical Engineer. Twenty years' Successful Sales Engineering experience preceded by 3 years' operating experience. Recently resigned as District Sales Manager of Nationally Known Company to act as factory representative. Desires represent two additional companies Houston area. Acme Engineers, Box 5155, Houston 12, Texas.

ENGINEERING Company contacting refineries, natural gasoline plants and chemical plants throughout the southwest desires to represent responsible manufacturers as distributor and service engineer for equipment and material used in these industries.

BOX A-922
The Oil and Gas Journal, Tulsa, Okla.

SITUATIONS WANTED

PETROLEUM CHEMIST—B.S. Chem. with graduate research work in lube oils. Over six years experience in control, research and development with western refinery. Familiar with all types of petroleum products and processes. Desires supervisory position. Veteran, married, age 33. Address Box A-896, The Oil and Gas Journal, Tulsa, Oklahoma.

MAINTENANCE — Construction Supersisor: Graduate Mechanical Engineer, 10 years experience, complete refinery, in maintenance-construction and as administrative assistant. Married; 35; children. Correspondence confidential. Minimum $6,500. For enthusiastic viewpoint, ability to plan imaginatively, to organize, get along with and direct people, contact Box A-894, The Oil and Gas Journal, Tulsa, Oklahoma.

Ex-Navy Lt. with degree in petroleum engineering desires work with oil company in Mid-Continent or Gulf Coast areas. Box A-918, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST with major oil company, age 29, with considerable experience, wishes to join active independent or small company on salary-interest basis. Prefer Okla. or Texas. Detail organization in reply. Box A-919, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER. Production and Sales Experience. Wide aquaintance in Southwest, wishes to buy interest in small concern. Marketing, manufacturing, or production. Box A-920, The Oil and Gas Journal, Tulsa, Okla.

PETROLEUM ENGINEER. Age 35. Sales, Production and Executive experience. Wide acquaintance in Texas, N. Mex., and Okla. Desires connection as manufacturers agent, sales, or as production engineer. Availabe Jan. 15. Box A-921, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED; Maintenance or construction work. Background: B.S. degree—mechanical engineering. Five years oil refinery experience. Box A-923, The Oil and Gas Journal, Tulsa, Oklahoma.

The Houston Geological Society is making an effort to locate positions for ex-service geologists and recent college graduates.

A committee composed of ex-service geologists

Todd, John D.—Consulting
Noland, O. W.—Humble O. & R.
Johnston, Harry W.—Union Producing
Mueller, Frederick—Skelly Oil

have contacted all operators thought to have need of geologists, geophysical crew members, or draftsmen.

The Veterans Service will route all those desiring such services to some member of this committee for advice and assistance.

HOW TO SELL THE CHICAGO AND MIDDLE WESTERN MARKET

Live wire sales representative with 15 years successful background, available to a manufacturer of Malleable and Cast Iron Pipe Fittings, Steel Pipe Nipples, Cast Iron Soil Pipe or Copper Tubing and Brass Pipe. I have orders on hand, also a very broad acquaintance with key buyers of, and major users of, these products in this territory, and my sound sales plan will assure maximum results. If your company has these meritorious products and is deserving of optimum sales distribution, it will pay you to consider strongly my comprehensive sales-representation for your coverage of this territory. Can give you a minimum guarantee of set dollar volume or you need not pay me one penny commission if I fail to meet quota during 90 day trial period. Write or Wire Box A-903, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

ANDREW J. BARRETT
The Philtower
Tulsa, Oklahoma

FINANCING

MONEY TO PURCHASE oil loans, oil payments and oil royalties in Texas, Oklahoma and New Mexico. Baptist Foundation of Texas, 201-03 Baptist Building, Dallas 1, Texas.

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Kentucky Fields

(Continued from page 117)

8-P-23, is now on pump and testing the McClosky at 2,440-48 ft. after an acid treatment of 3,000 gal. The well is showing for about 350 bbl. of oil daily. Total depth is 2,461 ft.

WESTERN KENTUCKY WILDCAT FAILURE

Henderson County: Hageman-Pond 3 Mann Estate, 300 ft. SWL and 300 ft. SEL. Lot 6, 22-R-23, dry at 2,520 ft., 1½-hr. drill-stem test of McClosky 2,476-2,520 ft. recovered mud and water, no oil.

EASTERN KENTUCKY

ASHLAND. — Activities in the Eastern Kentucky field of operation were limited during the week, with only one completion. Kentucky-West Virginia Gas Co. completed No. 5,627 on the W. J. Webb property in Johnson County, total depth 2,866 ft., dry.

INDIANA

EVANSVILLE.—Activity in Indiana continued to decrease during the past week with the issue of only 4 drilling permits. Completions, however, showed a gain over the previous week with 3 oil wells and 2 dry holes reported. The oil wells added a potential of 508 bbl. of oil daily to the state's production.

Locations have been staked for two new wildcats. These are the S. C. Yingling 1 Duckworth, SW NW SW 26-7s-14w, Posey County, and the Cherry & Kidd 1 Fannie Woodson, SE SW NW 19-2s-11w, Gibson County.

Appalachian Fields

(Continued from page 119)

and larger pocket which blew the tools up the hole some 400 to 500 ft. The tools are stuck at that point and are now being bypassed with a second string. A small increase in gas volume was noted continuing from the last gas pocket bringing the total open flow up to 50,000 cu. ft. It is believed that the top of the Silurian is within 175 ft. of the depth reached and a gas horizon is possible at that point.

During the week 16 new locations were announced and are located in Henry district, Clay County; Big Sandy and Elk districts, Kanawha County; Carroll, Jefferson and Laurel Hill districts, Lincoln County; Mannington and Winfield districts, Marion County; Cass and Grant districts, Monongalia County; Union district, Putnam County; Grant district, Ritchie County.

MARKET QUOTATIONS

Prices as of December 10, 1945

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.)	78-80†	73-75
Mid-Continent*	6.50-6.75	5.75-6.00
Gulf Coast	6.75	5.750
Northeast Coast	...	9.875
California	...	6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	25-70	18-34
Oklahoma (Group 3)	4.500	5.400
North Texas (f.o.b. plant)	3.500	4.200
North Louisiana (f.o.b. plant)	3.750	4.500
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana, avg. grav.	1.20
Illinois Basin	1.27
Pecos County, Texas	.88
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.00

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Okla-homa Kansas	Gulf Coast Texas	West Tex.*
16-16.9	$0.80	...	...	
15-15.9	.84	...	$1.05	$0.70
20-20.9	.88	$0.85	1.09	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.89
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	...	1.07	1.30	.94
32-32.9	...	1.09	1.32	.96
33-33.9	...	1.11	1.34	.98
34-34.9	...	1.13	1.36	1.00
35-35.9	...	1.15	1.38	1.02
36-36.9	...	1.17	1.40	1.04
37-37.9	...	1.19	1.42	1.06
38-38.9	...	1.21	1.44	1.08
39-39.9	...	1.23	1.46	1.10
40 and above	...	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended December 8, 1945

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gaso-line	Dis-tillate	Resid-ual
East Coast	705	19,218	14,770	7,364
Appalachian	154	3,705	801	457
Ill., Ind., Ky.	721	17,307	6,132	2,904
Okla., Kan., Mo.	365	7,729	2,641	1,090
Inland Texas	193	2,796	436	890
Tex. Gulf Coast	1,118	14,598	5,892	4,859
La. Gulf Coast	300	4,068	1,859	1,819
North La., Ark.	61	1,622	489	355
Rocky Mt.	113	1,770	524	701
California	743	14,091	8,862	24,484
Total 12-8-45	4,473	87,004	42,406	44,743
Total 12-1-45	4,690	85,596	44,274	46,534
Total 12-9-44	4,585	81,136	43,886	60,486

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
December 8, 1945	218,355,000
December 1, 1945	218,845,000
December 9, 1944	220,258,000

*Excludes unrefinable California stocks.

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